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ENGINEERING SCIENCE AND TECHNOLOGY

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International Conferences on Science and Technology

Engineering Science and Technology (EST)

September 2-5 in Budva, MONTENEGRO

ABSTRACTS
&
PROCEEDINGS BOOK

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Key Emergency Measure to Address the Continuing Development of General Loss of Electricity to the During COVID19 Pandemic Time

Vehebi Sofiu [1*], Sami Gashi [2]

Abstract: Supply of Electricity is an urgent demand and one of the biggest challenges that Kosovo has for stable electricity for all consumers in the country. The research refers to the global events in the case of the spread of the pandemic COVID 19, which means the economic recession and the worsening of electricity generating poverty is continuing to this day in all over the world. The time of the pandemic has changed the consumption and generation of losses of energy and the increase of losses in the network distribution, which means 'unsustainable developmental manifestations' and complex constraints of energy poverty. Reflecting the share of the decline of the industrial sector, especially energy intensive industries, in the total consumption of electricity, industrial use of energy, currently accounts for 30% of total consumption, In the comparisons of electricity billing and other technical factors, there is a continuous decrease from the middle of March 2020, when the closure of state borders and other businesses using electricity began, which is in fact in contrast to the increased share of commercial service and residential use in general consumption. The main purpose of this work is to promote development policies for management decision-making in the energy sector, to support energy supply and energy consumption services in the household sector, which in Kosovo is the main consumer of electricity. Use of EON technology Reality Virtual Education is the practical part of developing processes in the classroom 3.0 virtual learning system and solving emergency problems during the pandemic time that has gripped the globe it's a good opportunity.

Keywords: Energy consumption; electricity losses, sustainable development, AVR platform.

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Institution of Higher Education, UBT-College, Energy Efficiency Engineering

Besa Veseli [1]

Abstract: The main purpose of this paper is to provide data for management decision-making in the energy sector, which will support the economic, social and environmental aspects of sustainable energy development in Kosovo. The focus of the paper precisely specifies the aim of better understanding the relationship between energy supply service and energy consumption in the household sector, which in Kosovo is the main consumer of electricity, firewood and heating services central.

Of particular importance in this process is electricity, where due to the pandemic caused by COVID-19 disease, distance learning is broadcast on Kosovo public television at certain times, while due to the closure of many economic activities in some sectors of work is being done from home.This current situation that Kosovo and the whole globe are facing has increased the demand for electricity among household consumers.

As well as the interconnection of economic development in terms of electricity demand at this time when everyone is called to stay home, due to avoiding the spread of the pandemic is definitely the demand for communication technology (internet), where it becomes possible to realize distance learning and the realization of tasks and requirements for efficient work in pandemic times, to make staying at home as easy and enjoyable as possible for all people who carry out their work through the Internet. The current situation of the Covid-19 pandemic has had an impact on improving air quality.

Keywords: Electric energy, Economic development, Online education, Air quality, Pollution parameters, Health effects.

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Evaluation of Ship Profiles in Istanbul Port Region with Two-Stage Clustering Analysis

Fırat Bolat[1*]

Abstract: The increase in industrial production and thus world trade has also increased the significance of the maritime sector further. Ports are of strategic importance as trade points in this sector. Strategies for reducing maritime transport costs and waiting-periods for the ships in ports cause increased competition between ports. Clustering theory focuses on the industries of certain regions defined as industrial zones. Most of the research on the maritime industry focuses primarily on its structure and economic impacts on national economies, without providing detailed information on particular economic and technological activities at the regional level. However, successful clusters are seen as means for regional and national growth. In this context, a two-stage clustering analysis was conducted, considering the different characteristics of the ship profiles that visited the area covering three administrative ports (Ambarlı, Tuzla, İstanbul) of the Istanbul Port Region. The clustering was made according to the type and flags of the ships that visited Istanbul Port Region, the ports they visited and the length of stay in the ports they visited. The clustering characteristics of the Istanbul Port Region were extracted with regard to the ship profiles.

Keywords: Clustering Analysis, Maritime, Transportation, Istanbul Port Region

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Knee Joint Reaction Force in Patients with Cerebral Palsy

Yaşar Mahsut Dinçel[1*], Derya Karabulut [2], Yunus Ziya Arslan[2,3]

Abstract: Understanding the biomechanics of the knee joint in cerebral palsy (CP) patients with crouch gait has substantial importance for the treatment decision making. Unlike from the clinical gait analysis providing valuable information about kinematics and kinetics of the patients, musculoskeletal modeling and simulation methods enable us to calculate joint loadings, thereby providing critical insight regarding the degeneration of the knee joints.

In this study, we aimed to investigate the difference between the joint reaction forces of patients with CP and healthy individuals. To do so, open-access gait datasets of children with CP having mild crouch gait and healthy-matched individuals were analyzed in OpenSim. The generic Rajagopal's full-body musculoskeletal model was scaled to each patient's anthropometric properties. Joint angles and joint moments were obtained using inverse kinematics and inverse dynamics approaches, respectively. Joint Reaction tool of OpenSim was utilized to calculate the joint reaction forces. Then, root mean square difference and the Pearson cross-correlation coefficient were calculated to quantify the difference between the joint reaction forces of children with CP and healthy individuals. Since the crouch gait pattern primarily affects the knee joint, results were provided only for the knee joint.

We found a significant difference between patients with CP and healthy individuals in terms of root mean square difference values, while no statistical difference was detected in terms of Pearson cross-correlation coefficient values. The average magnitude of the joint reaction force in patients with CP was higher than that obtained from the healthy group ($p<0.05$). The pattern of the joint reaction force of patients with CP was similar to that obtained from the healthy group ($p>0.05$). It can be deduced from the results that the magnitude of the joint reaction force differs significantly between patients with CP having mild crouch gait and healthy individuals, while profiles of the joint reaction forces of two groups have similar patterns.

Keywords: Cerebral palsy, Knee joint, Reaction force, Musculoskeletal modeling, OpenSim.

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Utilization of aluminum plant's wastes

Biljana Zlaticanin[1*], Branislav Radonjic[1], Sandra Kovacevic[2]

Abstract: Nowadays usage and recycling of industrial wastes have become an important research area. Waste management is a very important matter both for environmental perspective and the industrial point of view. An aluminium plant is placed near to Podgorica, Montenegro, and it is considered the main pollutant of Zeta valley, especially of the ground waters. The fly ash and red mud are the primary solid waste produced in the aluminum plant. Present work investigates the possible utilization of these wastes. Depending on the quality of the raw material processed, 1–2.5 tons of red mud is generated per ton of alumina produced. The treatment and disposal of this residue is a major operation in an alumina plant. Red mud is stored in a pool coated only with sand, so infiltration of waste substances in the ground water is possible. The problems related to waste production are becoming more and more important in relation to the progress of industrial development and to the improvement of economical conditions. In this research, chemical analyses of the used wastes were determined. The possibility of the use of the final products as a building material was discussed.

Keywords: red mud, characterization, product development, utilization strategy

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Building Community Through Slow And Empathic Steps The Reconstruction And Extension Of The Dominican Sisters's School Ensemble In Kőszeg

Péter Fejérdy [1]

Abstract: The Hungarian Dominican Sisters had to re-define themselves after 43 years of prohibition and persecution. It was their definite aim to rebuild their school and holistic educational system once famous all over the country. After the political change in Hungary they asked for the return of the building ensemble set up of a cloister, church, school. Although the buildings have been historic monuments, their ideal importance for the community is the most definite. The Hungarian congregation was established in this Baroque palace.

Our studio was favoured to be a partner in this process of re-definition of the school. During the past 10 years of cooperation we could determine goals and ideals in big scale and had enough patience to realize a number of them step by step, often fitting to the altering conditions and possibilities. Thus we had to meet up-to-date demands of a special education programme and the expectations of protection of monuments. It has been an exciting challenge. In this process the stable was converted to nursery, the cloister became the pupils' dormitory, the chapter-house was rebuilt to a new chapel. As the biggest intervention the construction of a new gym had been finished a year ago.

Keywords: Monument, Reconstruction, Renewal, Community, Collaboration

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Effect of Light Radiation on Phytosynthesis of Metal Nanoparticles

Havva Kaya [1*], Semra Kılıç [1]

Abstract: The usage areas of metal nanoparticles are getting widespread rapidly. Various chemical and physical methods are used to meet the increasing demand in the production of nanoparticles. Alternative nanoparticle production techniques have begun to be developed in order to avoid the negative effects of these methods on the environment and human health.

There are many studies proving the antimicrobial and antioxidant effects of metal nanoparticles used in biomedical fields, especially in the production of wound dressing materials. In addition, the number of studies on the use of metal and hybrid nanoparticles in processes for the removal of waste harmful to the environment and human health such as dyestuffs, organic and inorganic pollutants is increasing. The reason why the two areas given as examples are specifically mentioned is that a separate process is not required for the production of metal nanoparticles used in these fields. In these, reduction to nanoparticles is sufficient while producing wound dressing material and separation of waste, and no extra process is required for isolation of nanoparticles after they are produced. As an agent in these techniques, which are accepted as biological reduction of metal nanoparticles; bacteria, yeasts, plants and plant extracts are used. The components responsible for the reduction of metal particles in plant-derived nanoparticle synthesis (phytosyntesis) are alkaloids and flavonoids what include in plants. In this way, much lower rates pollutants are appear compared to chemical methods. Although the production of nanoparticles with phytosynthesis is very simple and environmentally friendly, the stages in the formation of the morphological shape and particle size of nanoparticles cause some difficulties. PH, temperature, reaction time and light radiation are effective in stabilizing the desired characteristics of the nanoparticles besides the plant material to be selected.

In this article, the critical effect of light radiation during the production of nanoparticles by phytosyntesis will be emphasized.

Keywords: Metal nanoparticles, Phytosyntesis of nanoparticles, Light radiation

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Production of dye synthesized solar cell from vat dyes

Kamila Sobkowiak[1*], Mustafa Karaboyacı[2]

Abstract: The aim of this study is to investigate the structure and working principle of dye synthesized solar cells and to produce dye synthesized solar cells from vat dyes. The ancestor of vat dyes is now indigo, which is a synthetically produced natural dye now, and they have reduction-oxidation properties. Dye-sensitized solar cells have been extensively researched in recent years with the idea that they will be a promising source of energy in the future, due to their low cost, efficiency in low light conditions and absorption on the visible light spectrum. In this study, the conductive glass part of the cell was produced with among others sodium and bismuth-doped SnO_2 and ZnO nano coating by spray pyrolysis method. The performance and efficiency of the solar was measured with solar simulator. The thin film coating was analyzed by XRD.

Keywords: dye-sensitized solar cells, transparent conductive glass, spray pyrolysis, doped SnO_2 thin films, doped ZnO thin films

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Legislation On Plastic Bag Charging in Turkey

Başak Uçman[1*], Hamza Kandemir[2], Hüseyin Yazici[3]

Abstract: Plastic bags are made from crude oil, which is made into a hard or a soft material. Plastic bags have only existed for one generation. In this short time, their extreme convenience has made them widespread for all aspects of life, making them the synonym of waste. However, their decomposition is a very long process. In fact, they never fully decompose in seawater. Plastic bags cause great damage to the world due to reasons such as not dissolving in nature for many years, polluting the environment with toxic chemicals while dissolving and being carcinogenic. Recycling of plastic bags costs much more than their production. The recycled amount of these bags is only 1%. For this reason, many countries introduce new practices, taxation or prohibitions to reduce the use of plastic bags. In Turkey, it is known that between 30-35 billion plastic bags are used annually, representing 440 plastic bags per capita per year. In order to prevent esthetic and environmental pollution caused by the use of plastic shopping bags, which are sensitively focused around the world, and to prevent luxury consumption of plastic bags, several precautions have been taken in Turkey over years. By the beginning of January of 2019, a charging legislation have been introduced to costumers in order to decrease annual consumption of plastic bags per capita gradually. According to this legislative precaution, plastic bags were started to be sold for 0,25 Turkish Liras at the sales points. Target of the government from this legislation is to reduce the annual usage of plastic bags per capita up to 90 pieces by the end of 2019 and up to 40 pieces by the end of 2025. The Minister of Turkish Environment and Urbanization said that incomes from plastic bags will be used for several environmental projects such as bike and pedestrian paths, noise barriers and wastewater treatment facilities.

Keywords: Plastic bags, Consumption, Environmental damage, Trends in the world, Charging

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The Impact of AIS of International Vision University in the Realization of Online Exams in COVID-19 Pandemic

Aybeyan Selimi[1*], İlker Ali[2]

Abstract: Non-standard situations such as the spread of COVID-19 endanger the health of many people. The crisis with this pandemic has imposed the dilemma of closing many of the institutions and banning the physical presence of employees and other participants in the functioning of the institutions. One of the systems that are particularly affected by this situation is the education system. Due to that, the teaching and realization of exams at universities have moved to the online version. In this paper, we give an analysis of the impact of the academic information system (AIS) in the realization of online exams in the International Vision University. The data used in the research are obtained results of students who participate in the online exams. The sample size in our study contains 805 students from five faculties. The developed AIS is compatible with the Microsoft Portal. For the realization of online exams, our system uses the platform Microsoft Teams and online survey creator Microsoft Forms. In conclusion we give further works directions and our proposals for better realization of the online educational process.

Keywords: Exams, Data structure, Online platform, Microsoft Portal and Microsoft Teams.

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The impact of digitalization on business strategy Case Study- Volkswagen, McDonald's and Under Armour

Mirjeta Domniku[1*], Muhamet Ahmeti[2]

Abstract: Digitalization is changing the world. Data collection interaction, expansion of network, artificial intelligence and robotics, is enabling major personal changes, social and economic worldwide. Digitization is often being described as an accelerated and unstoppable process. However, it is not a force of nature, but a development driven and led by people. Therefore, it can and should be worked to get the right shape in businesses and their strategies. In order for this to succeed, the processes and effects of this revolution technological needs to be understood by the business.

Through this scientific paper we have tried to explain the importance of digitalization in a company, by continue with what data are needed to define the strategy and business objectives. The research methods we used to collect and analyze data, are a mixture between qualitative and quantitative methods. By identifying the factors that influence the success of modern companies in it so-called industry 4.0, like the current industrial revolution, the focus of scientific work will be on issues of how to plan modern strategy, in which areas to allow influence greater digitalization and how to enable business digitization in order to be in keep up with the competition.

In conclusion we have given the conclusions and opinion on the opportunities and risks of digitalization in business strategy, as well as how open and welcoming they should be technological changes.

Keywords: Digitalization, artificial intelligence, robotics, business strategy and technology.

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Analysis On The Implementation Of Iso 9001 Standard By The Construction Industry In Kosovo

Muhamet Ahmeti[1*], Driton Kryeziu[1], Jeton Zogaj[1]

Abstract: Kosovo Construction Industry Companies are operating in a highly competitive market and increasing the dynamics of their development. Based on this fact, the necessary information regarding the organization and implementation of processes based on standards, can have radical impacts on the successful operation of companies. A real competitive advantage can only be achieved by achieving a sufficient level of business influence, which depends not only on production processes but also on administration, customer service and other aspects of business operations. This means that companies in the Kosovo Construction Industry must aim to implement standards for meeting the needs and expectations of customers, employees, owners and companies in the broadest sense.

ISO 9001 is a Quality Management System. A Certified Quality Management System represents the official confirmation of a level of reliable business performance, as well as proves the commitment to continuous improvement and meeting customer's requirements. Therefore, the certification of companies in the Construction Industry in Kosovo with ISO 9001 is very important, moreover ISO 9001 has the priority to ensure that the product or service satisfies the customer's requirements on quality, products and services must be compatible with applicable regulations.

The benefits of companies implementing and certifying with ISO 9001 are enormous: greater understanding of all processes in the organization, improved documentation, raising awareness on quality, strengthening trust and connections between the organization and customers, saving and increasing the profit, facilitation of service development, staff involvement - continuing education, etc. Therefore, in this thesis, the knowledge on the implementation of the ISO 9001 standard by the Construction Industry in Kosovo will be treated in detail, based on facts and analysis.

Implementation and certification of a Quality Management System according to ISO 9001, in the first place is in the best interest of any company that conducts a business in the territory of the Republic of Kosovo, in the best interest of society and helps the overall economic development.

Keywords: ISO, ISO 9001: 2015, Standard, Quality, Customer, Quality control, Quality Assurance, Etc

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Electrospun Polyacrylonitrile/Polythiophene Fibers for Phosphate Anion Sensing

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Abstract: Electrospun fibers show excellent potential for diverse applications in tissue engineering, wound healing, drug delivery, materials science, chemical industry, energy storage, sensor and structural support due to their combination of unique properties such as large surface area, high porosity, great electrical conductivity, and high mechanical stability.

In addition, conducting polymers used in fiber structures exhibit an extraordinary range of materials due to their properties such as electrical and electrochemical properties, ease of processing, and the possibility of both chemical and electrochemical synthesis. Among numerous conducting polymers, polythiophene (PTh) is one of the important conducting polymers due to its good environmental stability, unique redox electrical behavior, ease of synthesis, and application in many fields.

In this study, polyacrylonitrile (PAN) electrospun fibers containing polythiophene (PTh) at different ratios (1 and 3 wt%) (PAN/PTh-1 and PAN/PTh-2) were produced using the electrospinning technique. The structures, the morphologies and the electroactivities of the electrospun fibers were characterized by Fourier transform infrared spectroscopy (FTIR), Scanning electron microscopy-energy dispersive X-ray spectroscopy (SEM-EDS), Thermal gravimetry analysis (TGA), the four-probe technique and cyclic voltammetry (CV). Thermogravimetric analysis results indicated the presence of PTh within the PAN fibers. The electrochemical behavior of indium-tin-oxide (ITO) glasses coated with the PAN/PTh, PAN/PTh-1 and PAN/PTh-2 fibers were investigated for different phosphate buffer concentrations by cyclic voltammetry measurements. These electrospun fibers containing PTh were used for phosphate anion sensing. For the PAN/PTh electrospun fibers, the oxidation potential increased with increasing phosphate concentration. The obtained results showed that the thermal stability and electrical conductivity of the fibers were affected by PTh. This study serves to underscore new recognition motifs in the design of PTh containing PAN fibers as anionic sensors.

Keywords: Anion sensing, electrospinning, fiber, polyacrylonitrile, polythiophene.

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The Assessment of Antibiofilm Activity of Chemically Modified Chitosan Using Quartz Crystal Microbalance

Neslihan Nohut Maşlakçı[1*]

Abstract: Surface properties play an important role in the functioning of biomaterials. It is known that bacteria form a layer called biofilm, which consists of polysaccharide, protein, and DNA. The biofilm layer causes economic damages in many areas such as medical applications, water treatment systems, and dairy businesses. Moreover, biofilm can lead to fatal consequences in infections associated with biomedical implants. Therefore, the biofilm formed by growth and cellular attachment on biomaterials can be replaced by surface modification of biomaterials. In this way, biomaterials can gain new properties.

In this study, the plasma modified-chitosan (PCh) was chemically modified with 5-ethoxy-2-methyl-benzofuran-3-carboxylic acid (E1). The electrospun fibers of modified chitosan were produced in the presence of supporting polymers (polyvinyl alcohol (PVA)) using in situ electrospinning and quartz crystal microbalance (QCM).

The structure of chemically modified chitosan was characterized by Fourier transform infrared spectroscopy (FTIR), X-ray photoelectron spectroscopy (XPS), and Photoluminescence spectroscopy (PL) analysis. The morphology of electrospun fibers was investigated using Scanning electron microscopy (SEM). Antibiofilm activity against *Pseudomonas aeruginosa* (*P. aeruginosa*) on a fiber-coated QCM electrode surface was examined as a function of time using flow-through QCM. QCM results showed that PCh-E1 fiber significantly decreases biofilm formation, with possibly greater contributions of E1.

Keywords: Antibiofilm, chitosan, electrospinning, fiber, quartz crystal microbalance.

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Regeneration of Landscape Architecture: Requalification of Scardamiano Seafront in Aci Castello, Sicily (Italy)

Fernanda Cantone[1*]

Abstract: Regeneration is defined as «reconnection, or reconstruction of a crucial relationship for the quality and suitability of the building fabric and its landscape: reconnection or reconciliation" between the identity elements of the place, "reanimation of an area deprived of its original functions». Regeneration, recalls a wider range of actions and becomes a network of knowledge and techniques that sets in motion with several different figures and tasks. The architect, in this sense, is still the bearer of solutions but is invited to compare them with other figures and other knowledge.

The economic crisis, with the reduction of the services provided, offers a model of city and territory of entrepreneurial type, in which the activities must be rethought to attract resources. Cities therefore become competitive because they must decide, independently, their future and increasingly involve representatives of the private sector, small and large owners, businesses and institutions for the achievement of their end. Urban re-generation process put into play the user requests, to involve them in decision-making, to share and discuss with them the architectural and redevelopment choices. Users are the community, made up of older people whose knowledge is helpful to identify the changes, young people to understand what they would like in the future, the adults to understand the problems of the place. Urban regeneration cannot take place without actions and policies that recognise the basic rights of all citizens to the satisfaction of fundamental needs: work, education, health, housing, participation in the public sphere, recognition of different cultural identities». The intention is to give back the soul of the city, a civil city, ecological, welcoming and alive, thanks to the new materials that the end of the last century has produced.

The study case is the Scardamian seafront in Aci Castello, a small village that falls in the metropolitan area of Catania and that has now been incorporated. The seafront Scardamiano joins Aci Castello to the fishing village of Aci Trezza, today thriving tourist village, full of gastronomic, tourist and accommodation activities, as well as bathing. This stretch of coast has undergone considerable transformations: once there were elegant Art Nouveau villas, today some are still alive but crushed between tall and imposing buildings. The area along the sea, rich in ancient rocks of thousands of years, not at all valued, is used for bathing, for pleasure, for different uses, without a common purpose. The research intends to propose design strategies for the seafront, through dynamics of participatory design and feasibility assessments, in terms of appreciation by users. The basis is the use of that functional mix that is the fundamental element for the realization of effective interventions.

Keywords: regeneration, seafront, design, technology.

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1. Introduction

Today, in Italy, the economic crisis, with the reduction of the services provided, offers a model of city and territory of entrepreneurial type, in which the activities must be rethought to attract resources. Cities of any size become competitive because they must decide, independently, their future and increasingly involve representatives of the private sector, small and large owners, businesses and institutions for the achievement of their end.

The construction market is saturated with buildings without quality and urban spaces abandoned or without care, immobilized by contradictory regulations, submerged by the most serious crisis since the post-war period, it is essential to invest in quality and technology. However, we must put at the centre of all "human value", the capacity of aggregation of the psychological world, to be united, to build an architecture of stable and shared relations (Morace & Santoro, 2014) for an economically sustainable architecture. The components of this process are to be found in the characters of the place and in the spirit of people.

The idea of regeneration seems to contain in itself on one side the recognition that the Italian city is in decline, on the other the awareness that you can intervene through recovery interventions (Musco, 2009). In this sense, today, regenerating means reconnecting, reconstructing a crucial relationship for the quality and suitability of the building and its landscape: «reconnection or "reconciliation" between identity elements of place, "reanimation" of areas deprived of its original functions» (Di Giulio, 2013).

Re-generation is referred to a "process that restores a previous condition of dignity, greatness and it returns initial properties". The field of action is the existing landscape that was constructed through the overlap of cultures. The concept of regeneration also includes the idea of continuity, to prolong the useful life of an asset or urban landscape, by returning the values lost in time. It means, above all, restore the quality of urban life and social relationships that define a built environment.

Urban re-generation processes bring into play the user requests, to involve them in decision-making, to share and discuss with them the architectural and redevelopment choices. Users are the community, made up of older people whose knowledge is helpful to identify the changes, young people to understand what they would like in the future, the adults to understand the problems of the place. The social component suddenly takes root and determines the choices of redevelopment. A design that starts from the community, which brings together memory, identity and innovation in a systemic and strategic vision.

Urban regeneration cannot take place without actions and policies that recognise the basic rights of all citizens to the satisfaction of fundamental needs: work, education, health, housing, participation in the public sphere, recognition of different cultural identities». We must give the soul back to the city, a city that is civil, ecological, welcoming and alive, thanks to the new materials that the end of the last century has produced.

The urban regeneration task is to improve the quality of the urban environment, to enhance the place identity, to restore lost soul in time; this is possible through forms of association and social, planning and thecnological experimentation. In this sense, the intervention project and studies on adopted trials play a decisive role in the developing strategy of regeneration.

Starting from these basic concepts, some European case studies were examined; the research investigated the state of the art in Europe through bibliographical analysis and a critical comparison.

In recent decades, in Europe, urban spaces have been recovered, especially in the heart of cities. Among these, the pilot cases are certainly those of Amsterdam and the Bjilmermeer district and the Jardin Plantagene in Paris, now well-established and well-known examples. Among the most recent, there is an organizational and design complexity that did not exist before and that involves multiple actors. It contains forms of facilitated purchasing, privatisation of public space and tax relief policies. The European experiences of Berlin, Bordeaux and Oslo are very different from each other in terms of strategy and design.

In Berlin, in 2013, the partnership between citizens' associations (Holzmarkt 25) and the Abendrot Foundation won an unused area along the bank of the River Spree, auctioned by the waste management company (BSR) in Berlin. The project idea, completed by 2023, is divided into four projects and provides for the creation of an incubator, a hotel, an entertainment room and a multifunctional village (residences and workshops/ workshops). The residences will be rented to various types of users, according to a balanced mix. The area, called Holmarkt, is now home to Berlin's nightlife and attracts many tourists for the curious mix of recycled materials and colorful murals.

Figure 1. Bordeaux and Berlin, examples of regeneration

In Bordeaux, the recovery of the General Warehouses, on the bank of the Quai des Queyries has become the flywheel for the entire area on which it insists. It was the key project for the city's candidacy for the Capital of Culture in 2013. The the nineteenth-century buildings were saved from speculation involving their demolition and through the creation of simplified companies and a social investment fund the interventions were financed. At a later date, a Darwin Ditation fund was created to support non-profit associations operating in the area (Cottino & Domante, 2017). Today Darwin, so is called the place, is a very animated place, with its 20,000 square meters of useful surface, an example of innovation on a large scale. It's a green economy center, with an urban farm, an XXL skatepark, free expression spaces for graffiti artists, an organic grocery store, a restaurant, work spaces, a motorcycle-polo field, and a spa with a charming second-hand furniture shop. It is a unique sociological experience, based on innovative and truly sustainable projects. This case study shows the success of a design and economic solution in which creativity is stimulated.

Figure 2. Oslo, example of regeneration

In the Nordic countries, an example is the Aker Brygge and Tjuvholmen districts in Oslo. The first is an equipped promenade near the port, on which a regeneration project has been implemented; public spaces have been designed to contain a mix of traditional and contemporary functions that attracts many types of people. This factor, attractiveness, together with the central location, are the elements of success of the project. The public spaces of Tjuvholmen (Aspen & Bjerkeset, 2017) were designed with the intention of combining social science and design, involving the entire process of formation of public space. Preliminary studies investigated routine activities, mundane aspects and daily events of interest (Koch and Letham, 2014)

Outside Europe and in the US in particolar, major regeneration schemes have allowed large parts of many cities to be owned and managed by private interests. In exchange of being allowed to add extra floors to their buildings, developers commit themselves to provide and manage a designated external or internal public space at street level, a so called bonus space. Another common and related phenomenon in US cities are Business Improvement Districts (BIDs). BIDs are delimited areas, most often in central parts of larger cities, in which businesses are required to pay an additional tax for the purpose of funding projects and providing additional services (sanitation, security, landscaping and other) that will enhance the general attractiveness of the area.

Consolidated studies (Carmona & Wunderlich, 2012) summarize the American trend: private investments aware of having to intervene in public spaces, interventions to improve safety and hygiene. The critical issues encountered concern the growing lack of interest of investors in the contexts in which they operate, the lack of power of the municipalities, the ever-decreasing commitment to safety and hygiene.

In Italy, the existing bibliography focuses on the fields of application, tools and purposes: urban regeneration focuses on the redevelopment of free and abandoned areas due to the problematic condition of open spaces, on densification and diversification, on social and environmental sustainability, with particular attention to greenery and natural systems. The instruments are the elimination of degradation, security and green; the aim is the development of a local social useful to strengthen relations, solidarity and, above all, the sense of affection for places.

Finally, the regeneration concept must coexist with the characteristics of the landscape on which to intervene. The landscape can be called "cultural landscape" (definition of the UNESCO World Heritage Committee) when it is a geographical area that represents the work of nature and man, in which cultural heritage is not confined only to the urban environment but also to its rural areas (Bondir & Cugno, 2015). In fact, landscapes that involve a variety of ecosystems have a high potential that motivates the development of the economy and tourism in rural areas and are fundamental elements of it (Carneiro et al., 2015; Lane & Kastenholz, 2015). However, different rural areas and communities have different social and economic needs, resources and

characteristics. For this reason, it is necessary to define the adequacy of local needs and characteristics.

2. Material and Method

The research begins inside the "Ecomuseum of the Riviera dei Ciclopi". This institution, approved in 2014 and financed in 2020 by the Sicilian Region, carries out an action of socio-economic sustainable development, aimed to achieving economic objectives for the protection of the social heritage, environmental and institutional of the municipality of Aci Castello. The aim is the enhancement of environmental resources, keeping in balance the needs of current generations, without devastating the wealth that will serve future generations. The author is Coordinator of the Scientific Technical Committee. Inside of ecomuseum institution, great attention is given to the regeneration of the coastal area and from this starts the research that also has the approval of the municipal administration of Aci Castello.

2.1. The case study

Aci Castello is a small town in the metropolitan area of Catania, in south-eastern Sicily and it is a village very popular with tourists and temporary residents.

Figure 3. Aci Castello And Scardamiano Seafront

Its history is concentrated around the beautiful Norman castle that stands on a hill overlooking the sea and dates back to 1076. Near it was born the town that, around 1500, was surrounded by walls. Since the end of '800, with the demolition of the walls, the center has expanded and developed in line with the sea, both in the south (Catania) and in the north (Messina) direction: there are simple and powerful nineteenth-century buildings with one or two elevations, Art Nouveau cottages and large green spaces.

Figure. Ancient representation of Aci Castello Castle

The '60s, '70s and '80s were characterized by an excessive construction on these coasts: many houses are destroyed and many high buildings were built for apartments. The structures have limited the view of the sea from many points. A long coast road has been built to improve accessibility to these buildings and it has destroyed the rocks and the vegetational coastal, partially. The building speculation has made this place anonymous, characterized by an asphalt road and large buildings in reinforced concrete of four, five floors that overwhelm the few remaining valuable buildings.

The case study is the stretch of coast that leads from Aci Castello to the nearby hamlet of Aci Trezza, a small fishing village, famous for the novels and novels of the great writer Giovanni Verga. A place also rich in history and tradition: the promenade Scardamiano. It consists of a low and rocky coast, with a Mediterranean vegetation characterized by the Chritmun maritimum (sea fennel); here you see hyaoclastite with pillow and basaltic blocks with calcareous incrustations, rich of characteristic holes of the species Lithophaga lithophaga (sea date).

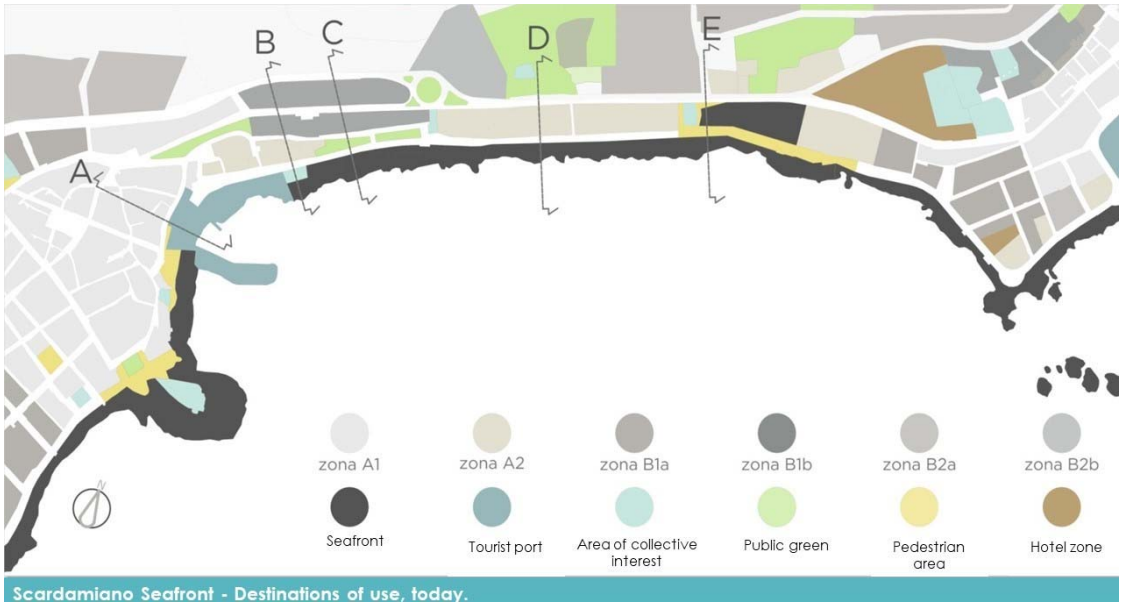

Figure 4. Scardamiano Seafront, Plan With Destination Of Use

Among the characteristics of the area emerges the presence of the sea and the ancient lava flows that have left an evident mark on the territory and make it one of the most geologically interesting territories of the coast. The eruptive activity of Etna has been, since the past, the subject of interest for travelers, writers and poets: we remember the myth of Aci and Galatea,

set here, or the quotations in the Odyssey of Homer. Travelers such as Schinkel, Houel and Goethe have sung its praises and portrayed the landscape, the cinema has set a masterpiece of Italian cinema: “La terra trema” by Luchino Visconti. The nearby protected marine area of the Riviera dei Ciclopi is important.

Figure 5. Local Rocks

Finally, the strong tourist-residential value of the area should be noted. Aci castle has been a tourist destination of second home since the beginning of the last century and the presence of the sea has attracted many people who have built their second home here. The result was purely commercial activities related to tourism: bathing establishments, diving and boat hire, maritime excursions.

Critical points of the area are the excessive cementification, with excessively high and voluminous buildings, without detachment between them and very close to the coast. The coast is narrow. In the 1930s, the construction of State Road 114 improved traffic but interrupted the natural slope of the neighbouring hill, and produced very important building interventions, totally saturating the existing space.

The area is free of greenery, leisure spaces and is in a state of semi-abandonment. The only activity is the transit of cars.

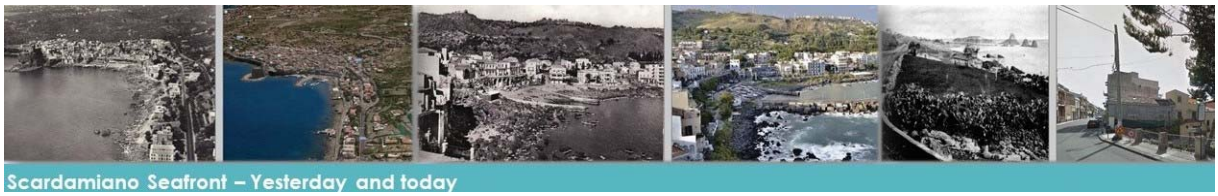

Figure 6. Scardamiano Seafront, Yerstarday and Today

2.2. The research

Urban regeneration and territorial actions can work only if they include all three pillars of the sustainable development triangle: economy, environment and society (Daniloska & others, 2015).

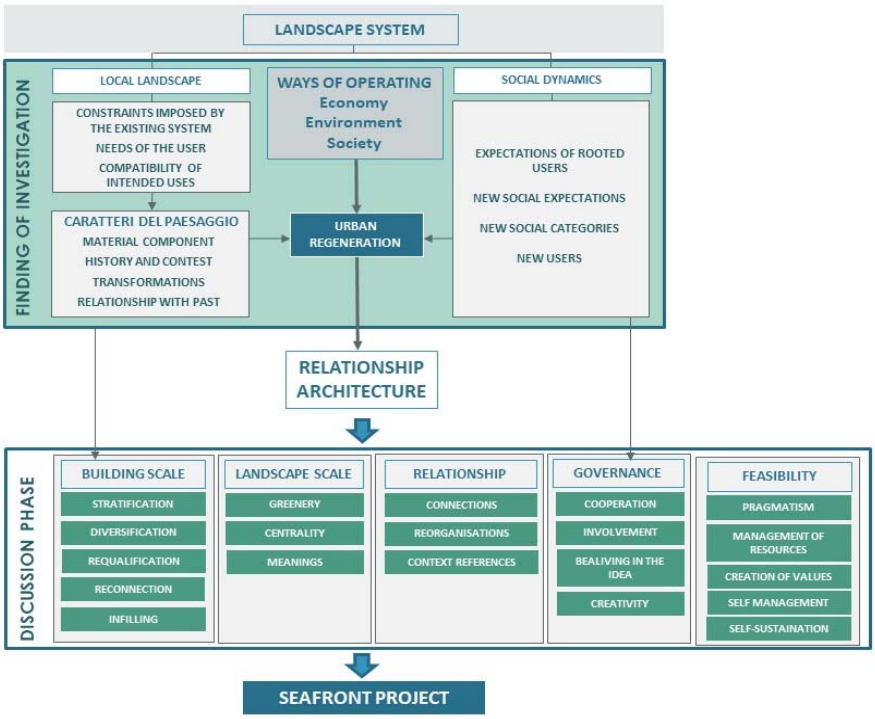

Figure 7. Scheme Of Method.

The study, therefore, considers them essential elements for any intervention, especially those who have a latent tourist vocation.

The research is articulated by phases and includes a first moment of study of the "state of the art" on the urban regeneration through the deepening of the cases of Berlin, Bordeaux and Oslo; a schedule and a comparison between successes and criticalities defines a list of values to be analysed and evaluated. These values have been included in the questionnaires placed to a sample of 100 people, 50 residents and 50 seasonal tourists, of various age groups, of culture, of income. This sociological survey has served to determine on the one hand the needs of users and the scenarios for new uses and requests, on the other hand the areas of greatest interest.

The first phase is a moment of bibliographic study and deals with the theme of urban regeneration linked to the concept of cultural landscape, through the filing and analysis of case studies of European, Italian and American which were reported to the existents in the introduction.

To address the theme of regeneration from a cultural point of view, the disciplines to be involved, in addition to architecture, are sociology, economics, anthropology. In fact, to regenerate the consolidated city, it is necessary to study social dynamics through the identification of the expectations of rooted users, of new social expectations, of new social categories aware of facing a choice of change, of users. In this sense, research explores the sociological and design themes.
In the first condition, analyses have been carried out on some key items for sustainable development and regeneration. They are:
- the expectations of deep-rooted users;
- new social expectations;
- the new social categories;
- the new users.

The survey, conducted through interviews, took a sample of resident population and a sample of seasonal population (second-home tourism). The questions asked were about impressions and desires for their city. From this initial analysis it emerges that the expectations of rooted users, that is, of those who have lived for generations in the territory, are linked to respect for the territory. Residents would prefer to see the territory less invaded by tourists and closer to the needs of residents, seasonal tourists with home in the municipality would like an increase in public services: links to Catania, green areas and leisure, cultural and entertainment activities. The new social expectations are determined by the needs of the young population, which has appropriated the spaces in front of the castle to carry out their afternoon and evening leisure activities. Hundreds of young people invade the castle square and take it away from the adults. The Scardamiano Seafront is totally ignored. The new social expectations therefore concern the demand for new spaces for young people, dynamic spaces, with more functions, not for their exclusive use. The advancement of technological progress proposes new social categories: communication operators, commercial managers, start-ups, green economy operators currently have no place in this place, anchored in a way of thinking and acting too traditional. The new users are the young but could be the travelers, interested in the landscape and cultural beauty of the territory. For them they need services and attractions.

From this analysis then emerges the need for a multi-level project that not only turns the waterfront into a place of nightlife, as happened in some of the international examples analyzed, but that can create economy especially with creativity, as it emerges from the request of many. The second condition, the context, in Italy (but not only) is very important. The analyses on Aci Castello landscape and its waterfront are:
- the constraints imposed by the existing system;
- the needs of users;
- the compatibility of the intended uses.

From the interviews it emerges how the sea and the landscape with columnar basalts are the elements to preserve and enhance. The requests of the users are the green and the aggregation spaces. An analysis of the compatibility to reuse, shows that the Lungomare Scardamiano is the ideal place to install new functions and expand the few already settled. The research has therefore produced a series of criteria for testing multi-scale and multi-level design ideas.

At territorial scale, interventions on the territory must concern the green, the meaning of the new use, the central and accessible location of the place. At building scale, eligible interventions are stratification, diversification, redevelopment, reconnection, infiltration. The project must take into account the existing connections, the need for a reorganization of the existing, the physical and cultural references to the context. From the point of view of governance, cooperation is needed, participation in both the design and management phases, believing in the design model, creativity. A contemporary project can be successful if you plan communication, if you share with the inhabitants and if you give value to the sense of belonging; fundamental are then self-management and self-sustainment. The case of Bordeaux and that of Berlin teach that there is profit in the rent of the built structures. Finally, we must not forget the concreteness, the pragmatism for the management of resources and for the valorization.

Table 1. Elements of Relationship Architecture for Scardamiano Seafront Project

BUILDING SCALE		LANDSCAPE SCALE		RELATIONSHIP		GOVERNANCE		FEASIBILITY	
STRATIFICATION		GREENERY	✓	CONNECTIONS		COOPERATION		PRAGMATISM	✓
DIVERSIFICATION	✓	CENTRALITY	✓	REORGANISATIONS	✓	INVOLVEMENT	✓	MANAGEMENT OF RESOURCES	
REQUALIFICATION	✓	MEANINGS	✓	CONTEXT REFERENCES	✓	BEALIVING IN THE IDEA	✓	CREATION OF VALUES	✓
RECONNECTION	✓					CREATIVITY	✓	SELF MANAGEMENT	
INFILLING	✓							SELF-SUSTAINATION	✓

3. Results

The project wants to regenerate a heavily degraded area, Lungomare Scardamiano; for this area the questions of users are pressing. The seafront should not become only a place for young people, but a multifunctional place to meet the needs of multiple groups of users: young people, families, elderly.

Figure 8. Scardamiano Seafront, Regeneration project

The elements for a relationship architecture were analyzed in function of the Scardamiano seafront and from them arise the design scenarios. Leaving aside the economic component for which public/private participation is suggested, the elements through which the project has passed are:

- Diversification: one characteristics of the project is the diversification of functions that is a functional mix, to be attractive, economically advantageous, respectful of the needs of users.
- requalification: it gives social but also design and technological quality to the project. Articulation of the spaces for multiple user ranges, possibility of different uses and stackable, care in the choice of materials are the elements included in the project.
- reconnection: you must check the connections that have been studied to improve the practicability, accessibility and use of spaces never exploited until now.
- infilling: the soil has been used selectively, especially to assess the presence of columnar basalts. They were highlighted, illuminated in the evening and not covered by platforms.
- greenery: many spaces have been used for spontaneous and equipped greenery.

- centrality: the central location of the area produces great interest. All categories of users can utilize the Lungomare, for different reasons and needs.
- meanings: the seafront acquires meaning, enhances the elements of the landscape, shows them off and makes them usable, open to the public.
- reorganization: the reorganization of spaces and functions is inherent in each project. Both are the result of study, analysis and comparisons with the user groups present in the area. The result is an articulated and new project for the city.
- context references: the context is an other central point of the project; finally, it highlights the geological character of the area, it proposes a direct contact with the sea with many accesses, with functional areas on the sea.
- involvement: the project is the result of meetings with the community, in particular interviews which have highlighted the needs and desires of those who live, who stay in the summer, those who spend a few hours of leisure in this place.
- bealiving in the idea: it is indispensable to realize the project. it takes will.
- creativity: it is at the design stage of the project but also at the management stage. Spaces for activities should be allocated to innovative, attractive activities and not at the earliest possible request. Here, the commercial strategy must be rigid and choose economically advantageous but new and stimulating activities.

The feasibility category covers the sectors environment, society and economy. It provides for public and private investment and explains the economic capacity of the project. The self-supporting during the management phase is fundamental: it would be ideal to set up a management company; these are choices that can be suggested to the municipal administration.

4. Discussion and Conclusions

In Italy, it is no longer the time for projects of indefinite spaces and multi-function buildings; today, regeneration requires precise functions, economic, cultural and social interests defined since the conception phase. The project is also based on the potential of the area and its criticality, opportunities and risks. Potential: protected marine landscape (nature reserve), central area and passage for many users, ancient and not valued basalts, tourist vocation, near the Norman Castle, the stacks of Aci Trezza (visual views), place rich in history.

Criticality: lack of services for the public and tourists, lack of parking, lack of areas of collective interest (solarium, gardens, squares, spaces for young people), few access to the sea made with concrete ramps thrown directly on the basalts ancient. Opportunities: improvement of the standards of livability of urban spaces, increased interest in places of high cultural value, exploitation of activities related to the sea (solarium, boat rental, diving center), access to the sea, use of empty areas for functions related to wellness (sports and fitness, play, relaxation). Risks: lack of economic resources, lack of political will, deterioration of the coastal zone.

The project is based on these important considerations. It provides docks for boats, squares and green areas, both shaded and sunny, theater on the sea, cafeterias, a cycle path, cultural paths between the balsalti, exhibition areas, areas equipped for sport (basketball, volleyball, free climbing, fitness), buildings in xlam to accommodate reception functions (info point, bike rental, boat rental, ticket sales for shows, refreshment points).

Figure 7. Scardamiano Seafront, Area 1, Project

The project has a strong design characterization that is seen in the forms given to the spaces reminiscent of columnar basalts. The materials are sustainable and reversible, the use of soil expanded on the coastal strip without ruining it.

It is a project that could interest private investors, as well as in Berlin and Bordeaux, who could earn from the rents of buildings for business. For once you could regiment commercial licenses, choosing not only catering business as it happens too often.

Figure 8. Scardamiano Seafront, Area 1, Project

Compared to the literature under consideration, the project proposes a model that is quite rigid in its intentions but flexible in its implementation. The fixed points of the project are the values defined by the needs of users but also and above all by the cultural value of the area. In the considered studies, the interest was directed only towards the needs of the users and the areas were recovered accordingly. Here, the two values are equally important and propose the protection of the marine habitat, the tourist and public use of large areas left to carelessness and abusiveness.

Figure 9. Scardamiano Seafront, Area 1, Project

For Italy it would be a new project in the basic motivations, a regeneration towards an efficient use of economic resources, an added value for the territory. The research proposes an idea of regeneration based on exchanges and increases in resources for the quality of heritage, but taking into account the propensity of goods to different possible objectives. Another element to consider is the strategy of increasing the value of both exchange and use.

Acknowledgements

Drawings and Project of Scardamiano Seafront and the relative images are taken from the degree thesis of Giuseppe Matteo Puglisi entitled: itinerary among columnar basalts. Redevelopment of Scardamiano Seafront in Aci Castello(CT). Supervisor: prof. Fernanda Cantone, Catania University, DICAR, SDS Architecture, Syracuse, Italy. Academic year 2019/20.

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Experimental Investigation on The Effect of Different Fill Materials on Cooling Tower Performance

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Abstract: Many air handling units and industrial refrigeration system needs chilled water year-round. For this reason, cooling towers are widely used industry. Cooling towers are complex devices in which mass and heat transfer occur together. Various improvements have been made to increase the cooling tower performance. These improvements are also related to filling materials. Filling material characteristics is important for the cooling tower performance because it improves both heat and mass transfer by increasing contact between water and air. In this study, the temperature values of the process water were evaluated for different fill types and fill heights used in the cooling tower.

Keywords: Refrigeration, Cooling tower, Experimental analysis

1. Introduction

Cooling towers are devices used for cold storage applications, industrial and comfort air conditioning applications, and closed-circuit cooling of the condenser cooling water of thermal power plants and process water used in the industry. In the past, to remove waste heat, water from a nearby source or existing water supply was discharged back into the environment after using. However, since the use of environmental waters disrupts the ecological balance and the purchased water costs increase day by day, such applications have been replaced by cooling towers.

The main functions of the filling materials used in cooling towers are to increase the contact surface between the air stream and the water stream, and to accelerate the heat discharge from the circulating water. For this reason, it directly affects the cooling tower performance. To operate efficiently, it must provide a high rate of heat transfer, a low resistance to air flow and a homogeneous water and air distribution throughout the tower. Filling materials can be many different types and can be manufactured from different materials. Generally, three types such as splash, trickle and film fills are used the most commonly. Although, film fills are most popular, depending on the characteristics of the water and ambient air, splash type or trickle filling materials are also preferred. Splash-type filling materials are designed to break down the mass of water falling across the tower into many small droplets. Along with the water surface exposed to cooling air, the amount of heat transferred to the air stream increases with transmission, convection, radiation, and evaporation. As the water falls along the filling material, the droplets collide with the successive splash bars that cause the redistribution of water and heat due to the formation of new droplets. In this way, the retention time of the water falling along the tower is prolonged. On the other hand, film-type filling material allows water

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to be spread over a wide filling surface in a thin film layer instead of creating droplets. For this reason, the working principle of the film type filling material is quite different from the splash type filler.

There are also various studies in the literature on examples of filling types used in cooling towers. Tomás et al. 2009, studied experimentally was conducted with a view to comparing the performance of fills of alternative materials such as coconut fiber, coconut husk and PET. The alternative fills were compared with each other and with the industrial fill, The results obtained show that the fills consumed a similar amount of power and support the use of alternative fills for cooling towers. Also, Raj et al. 2019, has been experimentally investigated an induced draft wet cooling tower using film, glass, and ball fills. Exergy destruction was also calculated for each of the fills and it was observed that film fills destruct less exergy as compared with glass and ball fills. Therefore, Singh and Das 2016, studied experimentally on a forced draft mechanical cooling tower using trickle, film and splash fills and analyzed some parameters such as effectiveness, water evaporation rate and tower characteristic ratio. Besides this, Milosabljevic and Heikkilä 2001, derived a mathematical model and computer simulation program to predict the performance of cooling tower that can also be used to predict the thermal performance of fillings (splash fillings, film fillings and splash-film fillings), it has been observed that, the differences of air velocities before filling material were less than %5. Loss coefficient correlations also studied in the literature for wet-cooling tower fills. Kloppers and Kröger 2003, determined the loss coefficient of a cooling tower fill (splash, trickle and film types) by measuring the pressure drop across the fill.

In this study, an experimental analysis was performed to compare the performance of the fillings of alternative materials such as PVC Film type and Splash type. Alternative fillings were compared to each other.

2. Experimental Setup

A real-size open-type cooling tower was used in the experiment. In this type of cooling towers, the cooled water is directly open to the atmosphere and the heat taken by the evaporating water during the cooling of the water is directly discharged to the atmosphere. The test device allows the adjustment of air and water flows through the tower with its frequency inverter and various flow control valves located on the pipeline. The heat load of the cooling tower is provided by gas fired hot water boiler. In Figure 1, the cooling tower test rig is shown schematically.

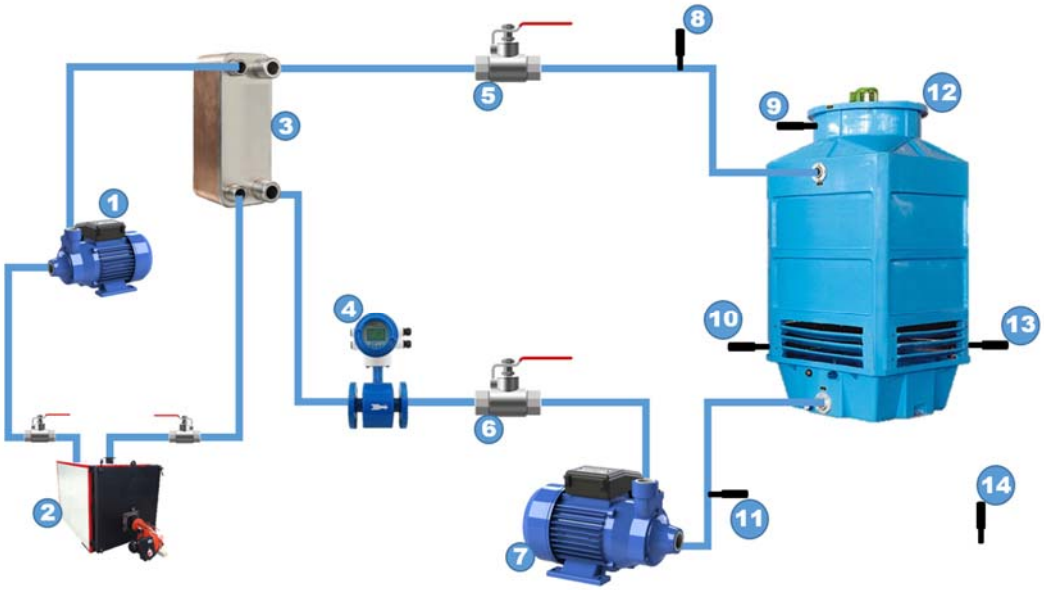

Figure 1. Experimental setup. 1: Boiler line water pump, 2:Gas fired hot water boiler, 3: Plate heat exchanger, 4: Flowmeter, 5-6: Flow control valve, 7: Cooling tower water pump, 8-9-11-14:Thermocouples, 12: Cooling tower, 10-13:Wet bulb temperature measuring devices.

For performance tests, temperature, humidity, pressure, and flow measurements were made. Values are recorded with datalogger and detailed analyses are studied. The cooling tower features used in the experiment are as in Table 1.

Table 1. The cooling tower features used in the experiments

Motor power (kW)	Number of fan blades	Fan blade diameter (mm)	Number of sprinklers	Cooling tower dimensions (m)
7.5	4	1500	15	2.4x2.4x4.1

The filling types used are PVC film type filler and splash type filler. Two types of film type filling are used. These are MF-22 film type filler and MF-18 film type filler. MF-22 itself is called MF-22 1800 and MF-22 1200 depending on the filling heights. MF-18 is also called MF-18 1500, MF-18 1200 and MF-18 900 depending on their height. The abbreviation MF-22 indicates that it is vertical flow film type filler, and water flows directly downward. The last number gives the fill height. The MF-18 model, on the other hand, shows that it is a cross flow film type filler and the water flows in a zigzag downward direction through the fill. The SPLASH 2700 model is a splash type filler. The efficiency of splash type filler is lower than that of film type filler. The filling height of SPLASH 2700 spatter type filler is 900 mm. Filling materials used in cooling tower and their properties are given in Table 2.

Table 2. Filling materials used in cooling tower and their properties

	Filling type	Filling properties	Filling thickness (mm)
FM1	MF-18	PVC Film type fill	900
FM2	MF-18	PVC Film type fill	1200
FM3	MF-18	PVC Film type fill	1500
FM4	MF-22	PVC Film type fill	1200
FM5	MF-22	PVC Film type fill	1800
FM6	SPLASH	Splash fill	2700

3. Results and Discussion

Test results of different types of filling materials for different heights were examined, respectively. All temperature values are the average values of the test results.

In the experiments, only the height of the filling materials was changed and the temperature changes of the water in the cooling towers were observed. In the experiment, 900, 1200 and 1500 fillers of MF 18 type of film type filler were used. As can be seen from the experimental results, the average water inlet temperature in the MF-18 900 filling was 30.6 °C and the average outlet temperature was 22.6 °C. The temperature difference was 8 °C. The average water inlet temperature of the MF 18 1200 filler was 31.5 °C and the average outlet temperature was 22.9 °C. The temperature difference was measured at 8.6 degrees. The average inlet temperature of the MF 18 1500 filler was 30.6 °C and the average outlet temperature was 23.2 °C. The temperature difference was measured as 7.38 °C. Considering the temperature values, although the inlet temperature water for MF 18 1200 filler at the highest temperature, it provided more temperature drop and cooling compared to MF 18 900 and MF 18 1500.

In the experiments, MF 22 filling type was used at 1200 and 1800 heights. Considering the test results, the process water inlet temperature in the MF 22 1200 filling was 36.1 ° C and it comes out at 30.6 ° C. The temperature difference was 5.4 °C. The water inlet temperature for MF 22 1800 filler was 33.3 ° C and it comes out at 28.9 °C. The temperature difference measured 4.3°C. Considering the temperature values, although the water used in MF 22 1200 filler has entered at a higher temperature, more temperature drops, and cooling was provided compared to MF 22 1800

Splash 2700 type of splash type filler was used in the experiment. Considering the experimental results, the water inlet temperature of the Splash 2700 filling was 36.2 °C and outlet temperature was 29.3 °C. The temperature difference measured 6.9 °C. The efficiency of the splash type filling is lower than the film type filling. It is possible to explain the reason as follows; the process water of cooling towers using film type filling is completely clean water, the process water of cooling towers using splash type filling is more polluted, in other words, there are substances (such as very small pieces of metal) in the process water. In addition, splash type filling is used at higher temperatures than film type filling.

Table 3 shows the results of the experiments for all filling types.

Table 3. Experimental results for filling types

	Water				Air			
	$Q_{w,m}$	$T_{w,i}$	$T_{w,o}$	ΔT	$T_{a,i}$	$\varphi_{a,i}$	$T_{a,o}$	$\varphi_{a,o}$
	(m^3/h)	(^0C)	(^0C)	(^0C)	(^0C)	(%)	(^0C)	(%)
FM 1	44.3	25.3	20.54	4.76	22.2	46.80	23.3	99.80
	44.1	29.19	22.03	7.16	22.4	48.10	26.1	99.90
	43.4	32	23.44	8.56	21.5	53.40	28.4	99.90
	44.2	34.9	24.4	10.5	22.8	52.40	30.8	99.90
FM 2	44	25.6	20.7	4.9	20.3	50.10	23.9	99.90
	45.1	28.85	21.89	6.96	20.1	50.20	26.4	99.90
	44.7	31.98	23.31	8.67	20.8	49.90	28.9	99.90
	44	34.7	23.97	10.73	20.4	50.20	30.4	99.90
FM 3	45.6	25.7	21.61	4.09	19.9	75.6	27.2	99.9
	45.7	29.5	23.23	6.27	20.2	74.5	29.6	99.9

	45.3	32.09	24.01	8.08	20.1	74.3	31.2	99.9
	45.1	34.8	24.28	10.52	20.7	74.5	33.1	99.9
FM 4	39.1	30.81	26.81	4	20.9	59.10	28.4	99.90
	39.2	33.46	28.21	5.25	19.5	59.40	31.7	99.10
	39.4	34.3	30.64	3.66	20.9	48.90	32.1	99.00
	39	36.53	31.84	4.69	18.9	68.60	35.4	99.90
FM 5	39.8	31.18	28.04	3.14	22	50.50	31.3	99.90
	39.8	32.5	28.95	3.55	22	46.30	31.8	99.90
	39.8	34.41	29.99	4.42	23.3	47.20	34.3	99.90
	39.8	36.07	29.47	6.6	19.4	59.20	35.2	99.90
FM 6	57.6	31.85	28.11	3.74	28.7	64.5	30.2	94.5
	34.6	32.77	27.63	5.14	28.8	61.7	29.2	91.8
	57.6	34.77	29.7	5.07	28.5	66.3	31.7	96.4
	57.6	39.67	31.75	7.92	27.7	70.1	33.4	99.9

4. Conclusions

Cooling towers are used in industries and processes such as industrial refrigeration, power plants and many manufacturing companies where process cooling is necessary. Also, cooling tower systems can be used to provide comfort cooling for large commercial buildings like airports, schools, hospitals, or hotels. There are many parameters that affect the performance of cooling towers used in many areas, one of them is fill material. Cooling tower fill material is the important factor to extend the cooling water residence time, increase the heat transfer area, increase heat transfer, and uniform distribution of water.

In the present work, a cooling tower is studied experimentally to analyze effect of different fill materials to tower performance. In the study, 2 different types of fill material (PVC film type and Splash Type) were used at different heights. It has been seen from the calculations made with the data obtained from the experiments that the higher the filling height, the higher the cooling capacity. In future studies, these experimental data should be expanded and supported by theoretical study with the Number of Transfer Units (NTU) method for each fill.

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Food Science and Engineering: Challenges and Sustainability

Parin Somani

Abstract: The design, construction and operational industrial processes relating to areas in innovative food processing technologies have had a vast amount of research performed over the years. However, there are many sustainability challenges environmentally, socially and economically in the food system. The objective of this study is to identify current challenges faced in the food system, with the aim to obtain an outcome that can provide a sustainable solution for future generations inspired through past solutions. A systematic literature review was carried out through an electronic and manual literature search. The following databases were searched; PubMed, Lexis Nexis, Blackwell Synergy, FSTA, Science Direct, GALE, Google Scholar and other information sources, publications, grey literature, magazines and Journals. This study has identified that there are many challenges faced in the food system, however, currently sustainability is reliant on water, energy and raw materials. We should make use of natural food resources but by respecting biodiversity impacting positively on current and future generations. There have been many attempts to optimize the efficiency of food processes, withstand pathogens, improve food functionality, sensorial and nutritional food properties, reducing food wastage and spoilage, also supply and cost demands globally. With globalization and changes in population growth and climate change there a requirement from society to increase access and integrate in water resources that effects energy security, food security and water supply security. The economy seeks to create more solutions with less funding and environment is required to invest in aiming to sustain ecosystem services. By evolving past solutions, we can promote equitable a sustainable growth; food, water and energy security; productive environment. This research has identified innovation gaps in technology validation and demonstrations in relevant and operational environments in food systems. Investment companies need to take risks on innovative research study ideas by bridging the innovation gap and seeking to implement practical solutions to create a sustainable impact on future generations. This can only occur when users accept sustainable innovative food processes through more marketing, creating awareness of solutions which will generate an interest from scalable markets. Necessary action must take place now to save future generations.

Keywords: Food Science, Engineering, Sustainability, Water, Food Systems

1. Introduction

Food is a vital part of human survival within this world; thus, food production industries and sustainability have an important role to maintain within society. When we refer to the term sustainability we can define it as the degree to which a process or enterprise is able to be maintained, simultaneously avoiding long term depression of natural resources (Dictionary, 2020). We can view this as requiring great effort and determination or a challenging situation (Collins, 2020). Within contemporary life we are encountering many challenges relating to food production that stem from population growth, food quality and climate change (Garnett,

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2013). Design, construction and operational industrial processes relating to innovative food processing technologies have had a vast amount of research performed over the years.

Currently, the global population is over seven billion, however it is estimated that by 2050 the global population is expected to exceed nine billion, which will result in a requirement for 70% more food. As a result there is an urgent need to create food safety and security to improve food chain efficiency and effectiveness (King, et al., 2017). This will increase pressure on finite resources due to an increase in demand for food and dietary changes. The food system can be conceptualised in many ways. It generally refers to the processes that happen between the time they are grown or nurtured on the fields and the time they are consumed. The cycle illustrated in figure 1 demonstrates limited information but in cooperates distribution, retail and waste. It misses components of food systems that are drivers, influencing activities and outcomes. But it also misses the stakeholders who are necessary actors in the process.

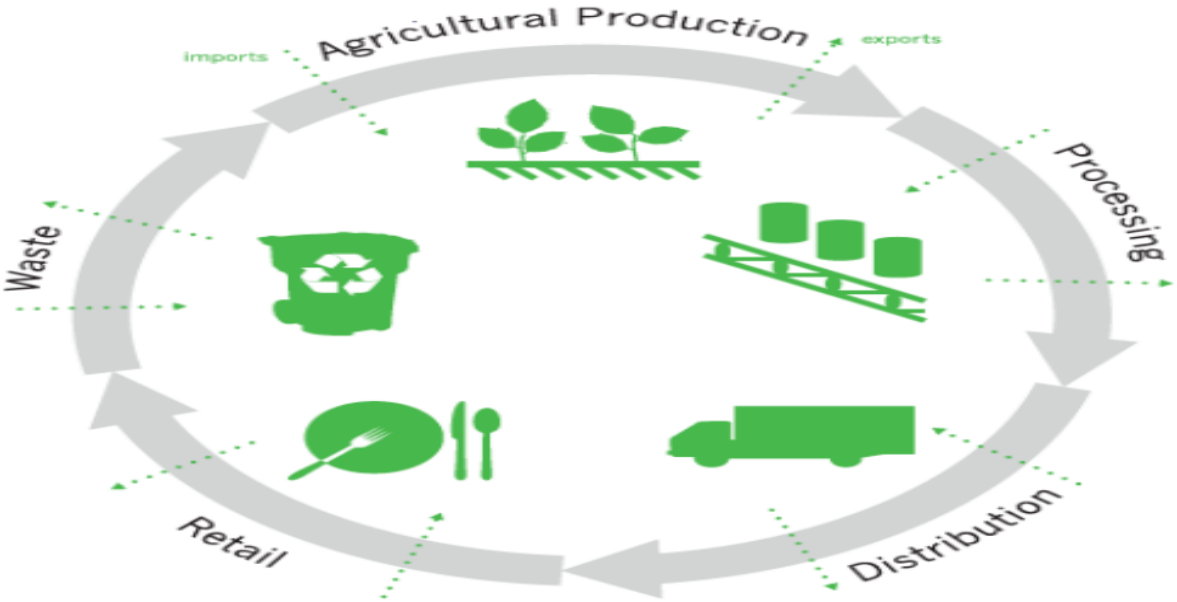

Figure 1. (Urbanist, 2013)

In comparison this holistic diagram in Fig.2 exemplifies a more comprehensive cycle which includes the physical supply chain processes, actors, activities, direct and indirect drivers, inputs and outputs. We can also see, how they are separated into their environmental, social and economic components within the process. Thus, illustrating that there are many sustainability challenges environmentally, socially and economically in the food system.

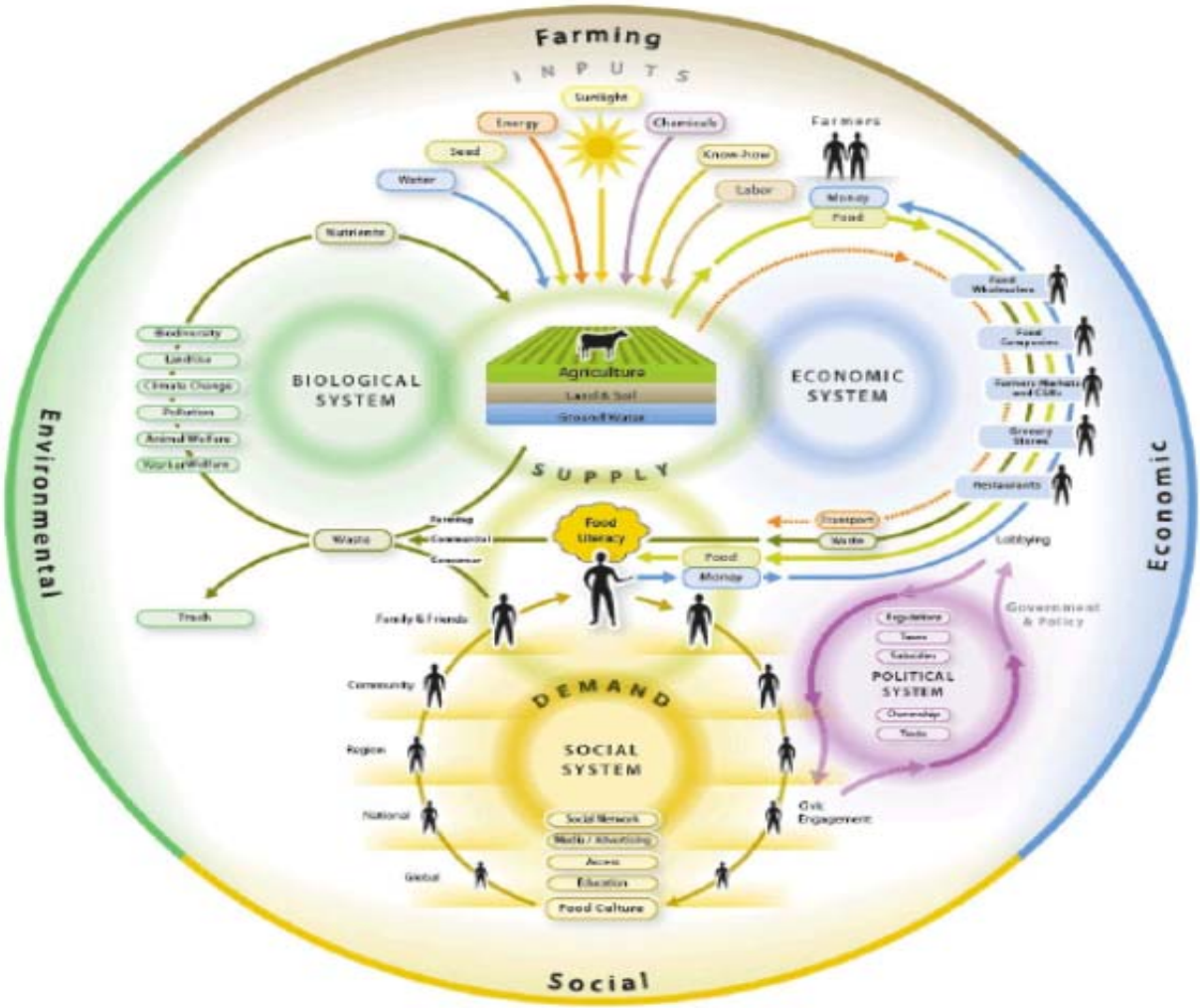

Figure 2. (CFET, 2020)

The objective of this study is to identify current challenges faced in the food system, with the aim to obtain an outcome that can provide a sustainable solution for future generations inspired through past solutions.

2. Method

A systematic literature review is carried out through an electronic and manual literature search. A variety of databases, information sources, publications, grey literature, magazines and journals are searched.

The four research questions below are devised from the objective to be addressed in this paper:

Q1 What are the current challenges faced in the food system?

Q2 What do we need, to ensure food sustainability?

Q3 What past solutions have been engineered to ensure food sustainability?

Q4 What steps can we take, to make sure we have a sustainable solution for future generations?

A number of electronic databases are searched to answer the research questions which include: ResearchGate, LexisNexis, PubMed, Medline, Science Direct, Blackwell Synergy, Web of Science and Google Scholar. An initial sensitive seach is conducted using the following key words: 'Sustainability' 'Food engineering' 'Food systems' 'Challenges' 'Solutions'. Numerous papers are identified; hence, in order to identify literary works that are specific to the research questions an inclusion criteria has been introduced. This includes published studies and grey literature on the current challenges faced in the food system. An exclusion criteria is devised comprising of the following points:

- Papers irrelevant to challenges faced in the food system are omitted
- Papers that focus primarily on food engineering without sustainability are disregarded
- Papers in languages other than English are excluded
- Papers which do not deliver adequate technical information regarding their approach are ignored

Having completed the search it is necessary to select the primary sources to use within this study: a total of thirty-two papers have been identified for investigation. Upon examining the papers four have been recognised as duplicates and not used. After reading abstracts and introductions a further two papers are rejected leaving twenty-six papers for investigation. Having read the full paper, one more paper is removed due to a lack of implementation details. Therefore, twenty-five papers are identified and used as primary studies.

3. Results

This study has identified that there are many challenges faced in the food system, however, currently sustainability is reliant on water, energy and raw materials. We should make use of natural food resources, but by respecting biodiversity, thus impacting positively on current and future generations. There have been many attempts to optimize the efficiency of food processes, withstand pathogens, improve food functionality, sensorial and nutritional food properties, reducing food wastage and spoilage, also supply and cost demands globally. With globalization, changes in population growth and climate change there a requirement from society to increase integration and access in water resources. This can effect energy security, food security and water supply security. The economy seeks to create more solutions with less funding, aiming to sustain ecosystem services through investing in the environment. By evolving past solutions, we can promote equitable a sustainable growth; food, water and energy security; productive environment. The sustainability of food production can be reliant upon economic infrastructure. For example, transportation, electricity, information technology systems and electricity are all necessary for agricultural development (Adenle, Manning, & Azadi, 2017).

Major challenges

Results have identified that there are major challenges encountered in food production sustainability, food safety and security, engineering and environmental challenges. The challenge that we are faced with in the contemporary world is related to the demand of fossil fuels in new energy sources when there is currently limited availability, with attention to potential excessive pollution as a result (Carmona-Martinez, et al., 2015). Bio sensing technologies have been utilised in food sustainability to help convert chemical and electrical energy from organic wastes and low strength waste waters. However, as a result of rapid industrialization , population growth, urbanisation a heightened pollution and unsustainable land use results have found that there is global land degradation which has affected approximately 1.5 billion people (Abhilash, et al., 2016). However, biotechnology has evolved

to create novel sustainable land restoration strategies using bioremediation through using high specific enzymes and only suitable for specific soil types and social conditions. Approximately 90% of water consumption, 70% of water obstructions, 30% of energy use and 8% of sewage treatment and water transportation is the global food production accounts associated with the leakages that's all found in the relationship between food, water and energy (Liu, et al., 2018). Efforts have been made to confront the challenges that stand in the way of enhancing food production.

Food safety and security

Food safety and security has great health implications for human beings and the animal kingdom. It is essential in every step of the food chain from farming strategies to production, the processes, packaging, transportation and also the final consumption of food (Lang & Barling, 2012). Due to this it is imperative to have the highest risk assessment and safety analysis measures in place. These can now be conducted through using elaborate technologies that at the forefront of technological advancements. They can include microfluidics, sensors and other bio sensing technologies which enable detection and management of food toxins, pathogens and nutrients (Dong, et al., 2015). Historically, the analysis of food safety had concentrated on intensive labouring, time management and specialist manual labourers. However, the use of microfluidics enables pathogens, food borne toxins, allergens, heavy metals on contaminants to be detected very quickly (Weng & Neethirajan, 2017). This can be a costly process, which can result in limited access to nutritious and safe foods for individuals with low financial means (Bazerghi, McKay, & Dunn, 2016). Therefore, individuals with low income can suffer malnutrition and starvation resulting in food insecurities. This can constitute to dire public health threats on social and political sustainability. There have been recommendations made for consumers to eat more plant based foods and reduce animal source foods as this is better for their health (Somani, 2020) and the environment (Willett, et al., 2019).

Food Packaging

Over the decades there have been developments in intelligent food packaging technologies which implement sustainable safety and preserve quality of foods. The use of real time monitoring packaging process is have improved to extend food shelf life so that consumers and manufacturer demands can be met (Sousa-Gallagher, Tank, & Sousa, 2016). Fortunately, nanotechnology has been used through the use of nanomaterials and robotic technologies in order to ensure food safety and quality, whilst reducing ecological footprint (Rossi, et al., 2017). The necessary protector from oxygen and moisture, spoilage and storage instructions have been considered. There is a dominant usage of titanium dioxide in food preservation as a food additive, because it is believed to be nontoxic to human beings. However, further research in this area needs to be conducted in relation to human absorption, digestion and long-term effects of titanium dioxide. The food supply chain does not generally focus on the consumer, but concentrations more on the traceability of foods until retail point. Thereafter it is left for the consumer to take the necessary precautions to ensure the food is stored in the correct conditions with the packaging to ensure safe consumption.

Food wastage

More than one third of the food produced is lost or wasted along the production chain (Lipinski, et al., 2013). This is approximately 24% of the total energy content of food that is produced. A reduction in the amount of food wastage or loss will be able to feed an additional one billion

people. We can see this illustrated through Fig.3, the food recovery hierarchy system that is suggested by the US Environmental Protection Agency. Food losses can occur before harvest as a result of processing problems which include handling, packing, transportation and retail sometimes it is as a result of infrastructure, of legal frameworks that constitute to a longer duration resulting in foods rotting. Fortunately, there are now intelligent packaging sensors that can reduce food wastage through using time temperature indicators , and radio frequency identification, this can ensure freshness and food packaging integrity (Poyatos-Racinero, Ros-Lis, Vivancos, & Martinez, 2018).

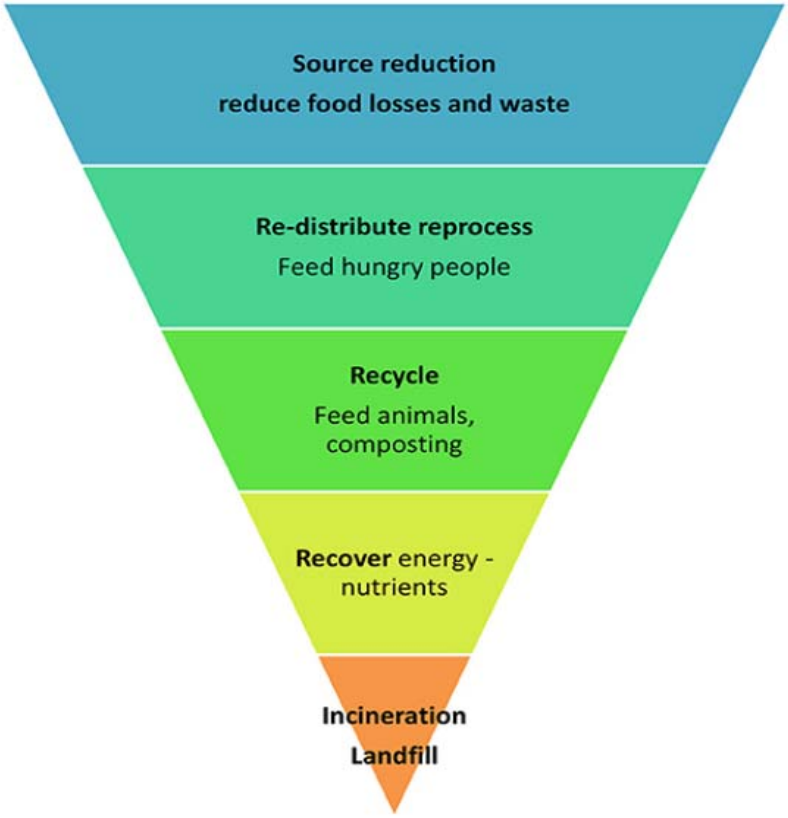

Figure 3. US Environmental Protection Agency

4. Discussion and Conclusions

There have been many endeavours to optimize the efficiency of food processes. There have been attempts to withstand pathogens through various means. Through controlling antimicrobial resistance, because if this is avoided then the cycle of nutrients transforms into a cycle of pathogens. We need to improve food functionality, sensorial and nutritional food properties, reducing food wastage and spoilage, also supply and cost demands globally. A shift in diet to plant-based foods in comparison to excess animal protein being consumed can help (Kearney, 2019).

The food production challenges include food safety and security, whilst simultaneously maintaining good quality in a diverse range of foods. There is an issue facing the economy when aiming to govern food systems as there are challenges encountered within the supply chain and food packing. The environmental challenge identified, encompasses the process when dealing with food wastage and the engineering challenge in creating new foods within an evolving society with the new generation (Baldwin, 2015).

Financial aid resources are required to be invested in further research and development in food engineering. This will enable safe sustainable food production as it can be driven to help agricultural businesses to mobilise implementing innovative technological solutions. In turn it will also help the economy to thrive and sustain food production. In order to improve food security leading to sustainability, we need to ensure there is readily available food or adequate food production that is accessible and can be purchased at reasonable prices. It needs to be ensured that the food we consume is safe and has enough nutritional content including energy, proteins and micronutrients. We also need to ensure that the processes are stable through longitudinal conditions (Helland & Sörbö, 2014). Biotechnology has proven to contribute to sustainability therefore further research should be carried out to transcend limitations to aid a commercial perspective on impedance biosensors and how they can be used in sustaining food production.

The increase in globalization and changes in population growth and climate change, has created a societal requirement to increase access and integration in water resources that effects energy security, food security and water supply security. The economy seeks to create more solutions with less funding and the environment is required to invest in aiming to sustain ecosystem services (Braun, 2010). By evolving past solutions with the use of modern day technology like artificial intelligence which can help in packing and food fraud, we can promote equitable a sustainable growth in food, water and energy security creating a productive environment.

Within the contemporary world food engineering is facing many challenges to develop new processes and products. This is identified through the amalgamation of new technological advancements and emerging knowledge concerning nanomaterials and computational materials (Sun, 2016). It should be our goal in society to ensure that the sustainability of foods is safe secure and of a good quality. Therefore, it is important that food engineering processes improve upon sustainable food production with flexible and efficient processes. However, good values need to be integrated to ensure a reduced energy consumption, increased safety and environmental protection. Particularly as modern-day food engineering has increased social accountability, global competition and governmental interventions. There are many challenges faced through political economic and environmental issues to ensure a safer global society. Biological solutions can potentially facilitate sustainable energy challenges, for example biofuels can be developed, bioelectricity can be generated stored and renewed. Although it may incur high cost at the outset, it will be more cost effective in the future compared to exhausting current fossil fuels. However future research is required to ensure efficiency on environmental impact.

This study has identified innovation gaps in technology validation and demonstrations, in relevant and operational environments, in food systems. Investment companies need to take risks on innovative research study ideas, by bridging the innovation gap, and seeking to implement practical solutions, to create a sustainable impact, on future generations. This can only occur, when users accept, sustainable, innovative food processes. This can be achieved through more marketing to create awareness of solutions, which will generate an interest from scalable markets. Necessary action must take place now to save future generations.

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Characterization of clays from Bijele Poljane (Cetinje, Montenego) for potential uses in the industry

Biljana Zlaticanin[1*], Milun Krgovic[1], Sandra Kovacevic[2]

Abstract: Clays, used in more than a hundred areas, are among the most important industrial raw materials. The suitability of clay for a specific application is based on its mineralogical and chemical composition. Generally, clays contain different nonclay minerals as impurities besides major and minor clay minerals. In this study, a sample of clay taken from the white bauxite deposit ("Bijele Poljane", Cetinje, Montenegro) was examined in term of its mineralogy, morphology and porosity.

Keywords: clay, characterization, kaolinite, illite

1. Introduction

Value of clay is recognized in agriculture, civil engineering and environmental studies. This is largely because of their high resistance to atmospheric conditions and easy access to their deposits near the earth's surface and low price. In developed countries, industrial uses of clays have many applications such as coating and filler pigment for paper, filler for paint, rubber and plastics, formulation additives in food, insecticides, cosmetics, pharmaceutics, and also as a major component in ceramics (Pialy et al., 2009). Clays are natural materials largely used by the prehistoric civilization to make household utilities. Presently, they are still used in the manufacturing of ceramic products such as bricks, porcelain, sanitary ware, floor and roofing tiles. Depending on the layer structure and specific properties, such as high specific surface area, ion exchange capacity, or hydration property, clay minerals were widely used in ceramics and building materials, paper industries, oil drilling, foundry moulds, and were also used as adsorbents, catalysts or catalyst supports, ion exchangers, and decolourizing agents (Erdoğan, 2015). The final product is strongly influenced by chemical and mineralogical compositions and particle size distributions (Kitouni and Harabi, 2011). Therefore, the knowledge of above mentioned properties of the natural clay materials is of great interest since it provides useful information in the selection of more appropriate raw clay materials associated with industrial applications. The particle size of natural clay materials influences their behavior during the technological drying and firing processes, and affects many properties of the building clay products, such as the plasticity, microstructure and the mechanical properties of fired materials (Bauluza et al., 2003). Clay based bricks are mostly used in Montenegro for building.

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2. Material ve Method

Mineralogical, chemical and microstructural characterization of the clayey rocks from the "Bijele Poljane", Cetinje, Montenegro have been performed. The whole area of the white bauxite deposit ("Bijele Poljane" mine) is characterized by the presence of clays. Figure 1 shows the geological map of the studied surrounding areas. It covers the geological information of the major clay deposits of Montenegro.

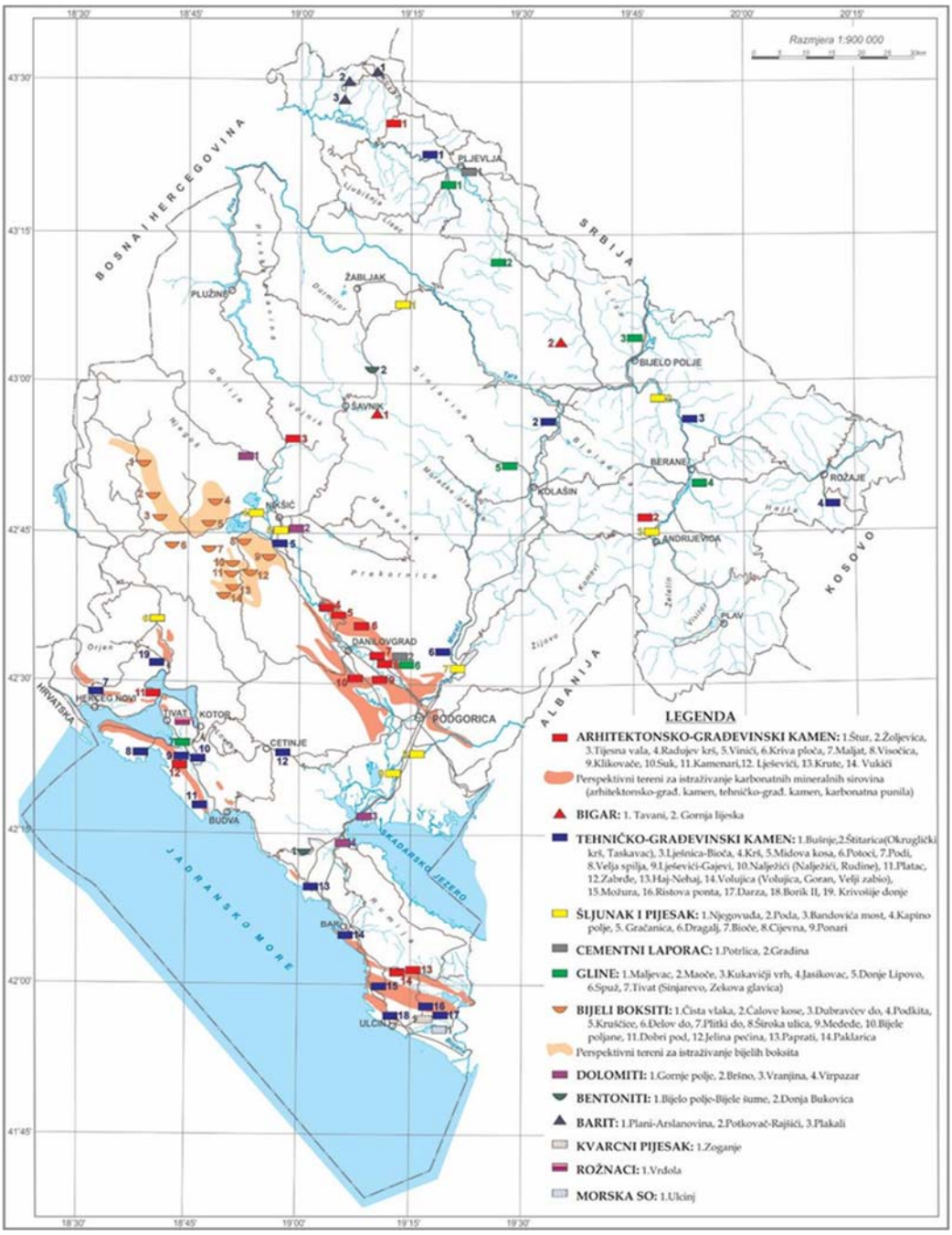

Figure 1. Geographical map showing the location of the study areas (orange color)

The investigated clay types from the White Bauxite Mine appear in layers and have different mineral content: clays with the presence of bauxite minerals, illite-kaolinite clays and clays with very heterogeneous mineral content. This mineral content gives the possibility of obtaining

different ceramic products (Kostić-Gvozdenović and Ninković, 1997). The most important differences in mineral content are mostly related to the content of bauxite minerals, clay minerals, iron compounds, quartz and calcite. The characterization of the investigated clays was done by the determination of the mineral content, chemical content and granulometric content.

3. Results

Chemical analysis has shown that the samples are mainly constituted of silica, aluminum and iron oxides (Table 1). Higher content of SiO_2 and Al_2O_3 together with total mass loss on ignition indicate higher content of clay minerals in the samples.

Table 1. Chemical composition of clay from Bijele Poljane

Oxides	Al_2O_3	SiO_2	Fe_2O_3	CaO	MgO	K_2O	TiO_2	lg. loss
Percentage by weight (%)	24.98	64.42	2.60	1.02	1.12	0.90	0.82	3.30

The mineralogical profile of the clay sample can be successfully examined using X-ray diffraction. The X-ray analysis shows the presence of the following minerals in the clay: kaolinite, illite, gibbsite, boehmite, anatase, hematite and clinochlore. Clay minerals are of either layered or fibrous structure. Kaolin group clay minerals are layered. Kaolinite - this clay mineral is the weathering product of feldspars. It has a white, powdery appearance. Kaolinite is named after a locality in China called Kaolin, which invented porcelain (known as china) using the local clay mineral. The ceramics industry uses it extensively. Because kaolinite is electrically balanced, its ability of adsorb ions is less than that of other clay minerals. Kaolinite is made up of silicate and aluminum oxide/hydroxide layers arranged in an alternating fashion. The existence of hydrogen bonding interaction between silicate and aluminum layers holds them together strongly. The chemical composition of kaolinite is $Al_2Si_2O_5(OH)_4$. The kaolinite structure can be seen from Figure 2.

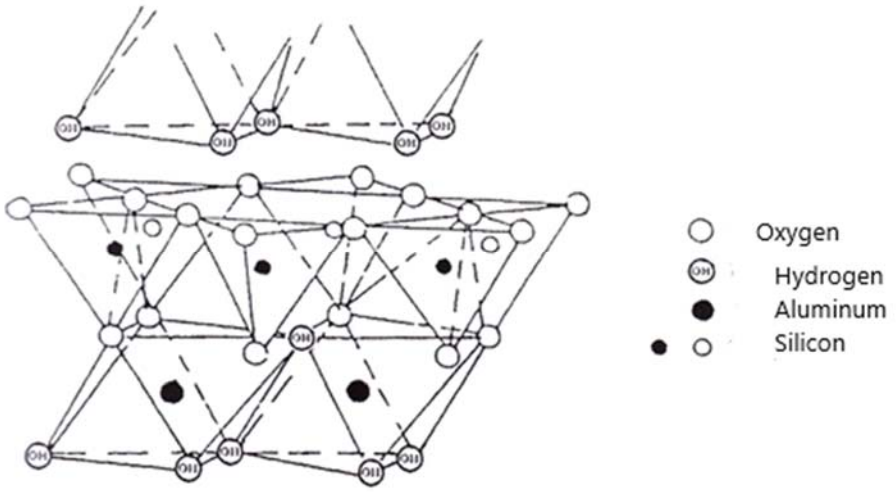

Figure 2. Structure of kaolinite

Illite - it is the weathering product of feldspars and felsic silicates. It is named after the state of Illinois, and is the dominant clay mineral in mid-western soils. The illite structure can be seen from Figure 3. Illite is a clay mineral mica, the structure is a 2:1 layer in which the interlayer cation is potassium. The size, charge, and coordination number of K is such that it fits snugly

in hexagonal ring of oxygens of the adjacent silica tetrahedral sheets. This gives the structure a strong interlocking ionic bond which holds the individual layers together and prevents water molecules from occupying the interlayer position.

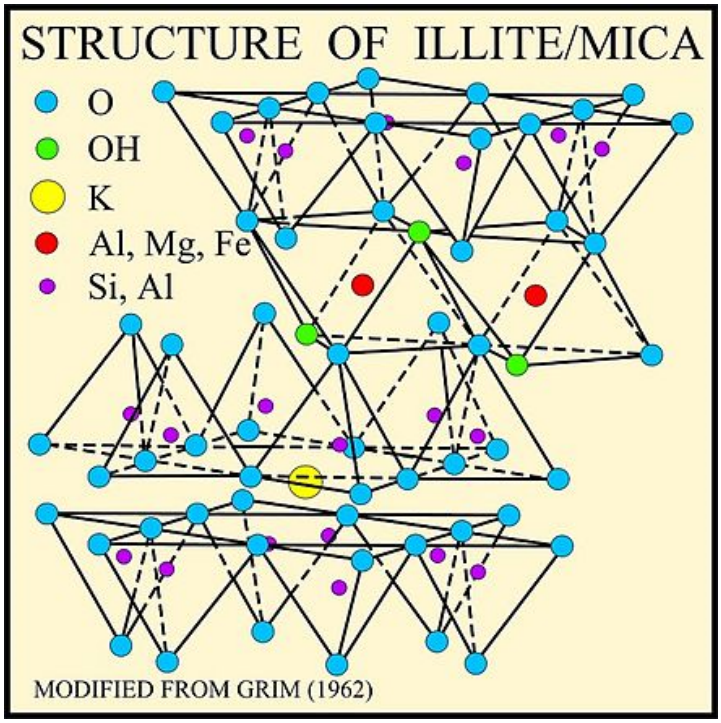

Figure 3. Structure of ilite

The results of the granulometric analysis show the average grain size of 60.32 μm in the samples. Loss of mass after gravimetric measurement at given temperatures shows that the samples have significant amount of water in their structure (≈3.3 wt% (110 ºC)). Based on their mineral composition and characteristics possible application could be in different types of construction industries.

4. Discussion and Conclusions

The chemical composition of the clay samples indicated that the presence of SiO_2, Al_2O_3 and Fe_2O_3 as major constituents, along with traces of K_2O, MgO, CaO and TiO_2. At high temperatures the composition of aggregate and natural binder materials, used in the manufacture of building materials in the construction industry, deteriorates, and such materials undergo mass loss. According to the results obtained from loss on ignition analyses, loss on ignition of clays was determined as 3.3%. As stipulated in the standard the maximum loss on ignition of a raw material can be 5% by weight. If the loss by weight of a raw material at maximum temperature is ≤5%, it can be used as a raw material in bricks, cement, and roof tiles. According to the analysis results, it was determined that the clays of the region can be used as building materials in bricks, roof tiles, and cement and as a binder.

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Synthesis Of Graphene Oxide Doped Boric Acid Solution

Banu Esencan Turkaslan[1*], Ayça Dalbeyler[1]

Abstract: Carbon-based nanomaterials are favored in recent years at many fields due to their unique chemical, electrical and mechanical properties. Especially graphene and its derivatives, can be seen as a very good alternative to other materials with its outstanding features such as easy functioning of the surfaces to provide various properties, high mechanical strength and maximum surface / volume ratio.

Graphene oxide (GO) is the most popular modification of the graphene which synthesized using various oxidizers. Graphene oxide has various functional groups (carboxyl, hydroxyl, epoxy) containing oxygen. These oxygenated groups allow the graphene oxide to function with different molecules. In this study, Improved Hummer method was modified to synthesize GO from graphite without using sodium nitrate ($NaNO_3$) which causes toxic gas formation. Boron doped graphene (BG) is a new nanomaterial with a single layer of carbon atoms in a hexagonal lattice. The addition of boron to graphene increases the surface activation area.

In this present research, we have synthesized GO with Modify Improved Hummers Method using graphite flake as starting material. Boron atoms were successfully doped into the GO structure with an atomic percentage of 2 (%w/w) by using boric acid (B) as a precursor. The B-GO was characterized using SEM/EDS and XRD spectral analyses.

Keywords: Boric Acid, Graphene Oxide, Modify Improved Hummers

1. Introduction

Carbon materials are known to be more environmentally and biologically friendly than inorganic materials, since the carbon is one of the most common elements in our ecosystem. In particular, graphite is a naturally occurring material that has been used in our daily lives for hundreds of years without critical toxicity issues (Tran and Mulchandani, 2016).

Graphene is an allotrope of carbon which is made up of single layer 2-dimensional structure nanomaterial with unique physicochemical properties (Kumar et al., 2017). The oxidized form of graphene named as “Graphene oxide” (GO) are produced by oxidation of graphite in a mixture of acid and oxidizing agent, is a water-dispersiblegraphene derivative (Marcano et al., 2010; Singh et al., 2016).

Graphene oxide (GO), has many extraordinary properties and has great potential among nanomaterials. Since its discovery, it has been studied by many researchers for a variety of novel applications due to its excellent chemical and physical properties, including low density,

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exceptional mechanical properties, large surface area, mechanical strength, and excellent electrical conductivity (Singh et al., 2016; Wang et al., 2011; Shil et al., 2016).

GO is commonly produced by using the Brodie, Staudenmaier, and Hummers methods or these methods with minör modifications (Botas et al., 2013) .In this study we demonstrate that GO can be produced using an improved Hummers method without using $NaNO_3$. This method decreases the cost and environmental duty of GO production. This modification, eliminating the evolution of NO_2/N_2O_4 toxic gasses.

Boric acid (H_3BO_3) is a weak acid of boron and exists in water-soluble form in the form of white powder (Etimaden, 2019). Boric acid is a cleaning agent obtained from borax used as a germicidal and bleach. For this reason, it is a cleaning agent that can remove biofilm (plaque) from the inner and outer surfaces of the medical equipment. It can be added to soaps and detergents due to its water softening and germicidal properties. Boric acid is also used for eye infections as an optical rinse, mouthwash and other topical applications, as it is a known antiseptic and anti-infective in the medical and cosmetic industry (Dolapçı, 2015).

2. Material and Method

Graphite powder (2 g) was mixed with 50 ml H_2SO_4 in an ice bath. $KMnO_4$ (4 g) was slowly added to the mixture. The solution was heated at 40°C for 30 min, and then diluted with 100 ml of water. In one hour, the solution was further diluted by adding an additional 200 ml of water, followed by the slow addition of 4 ml of H_2O_2 (30% *v*/*v*). After these steps the black graphite suspension was converted into a bright yellow graphite oxide solution. The aqueous graphite oxide solution was stirred for 3 h and centrifuged at 9000 rpm/min for 45 minutes to remove the unexfoliated graphite (Figure 1).

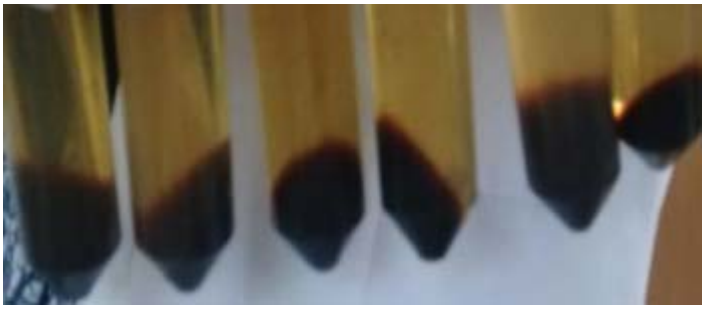

Figure 1. Graphene oxide

Then GO solution (1% w/w) was added to H_3BO_3 (% 2 w/w) with a magnetic stirrer then sonicated in an ultrasonic bath in order to distribute them homogeneously.

3. Results

3.1. XRD Results

The diffraction peak at $2\theta = 10.91^{o}$ observed in the spectrum is the peak of GO's crystal structure (Figure 2). The severe diffraction peak seen at 27.15 ° in the spectrum and low intensity peaks at about 14 and 57 ° belong to the crystal structure of H_3BO_3 [12]. As a result of adding H_3BO_3 to the GO structure, no significant change was observed in the diffraction peak position (2θ =

10.91º) of GO. However, as a result of the addition of H_3BO_3 to the structure, the peak intensity of GO has significantly decreased due to the rearrangement of GO layers (Zhang et al., 2012).

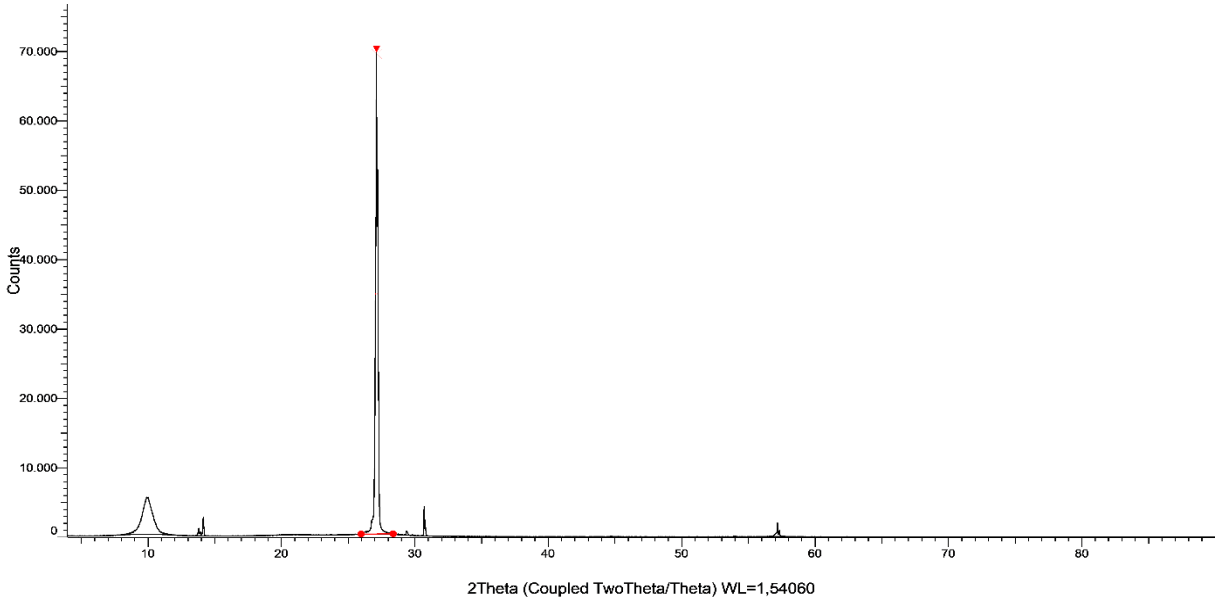

Figure 2. XRD Patterns of H_3BO_3 doped GO

3.2.SEM/EDS Results

As it can be seen in Figure 3.a. H_3BO_3 surface morphology consists of granular structure of different sizes. After GO doped with boron, granular H_3BO_3 crystals insert between the layers of GO and a homogeneous structure of H_3BO_3 doped GO is formed (Figure 3. b).

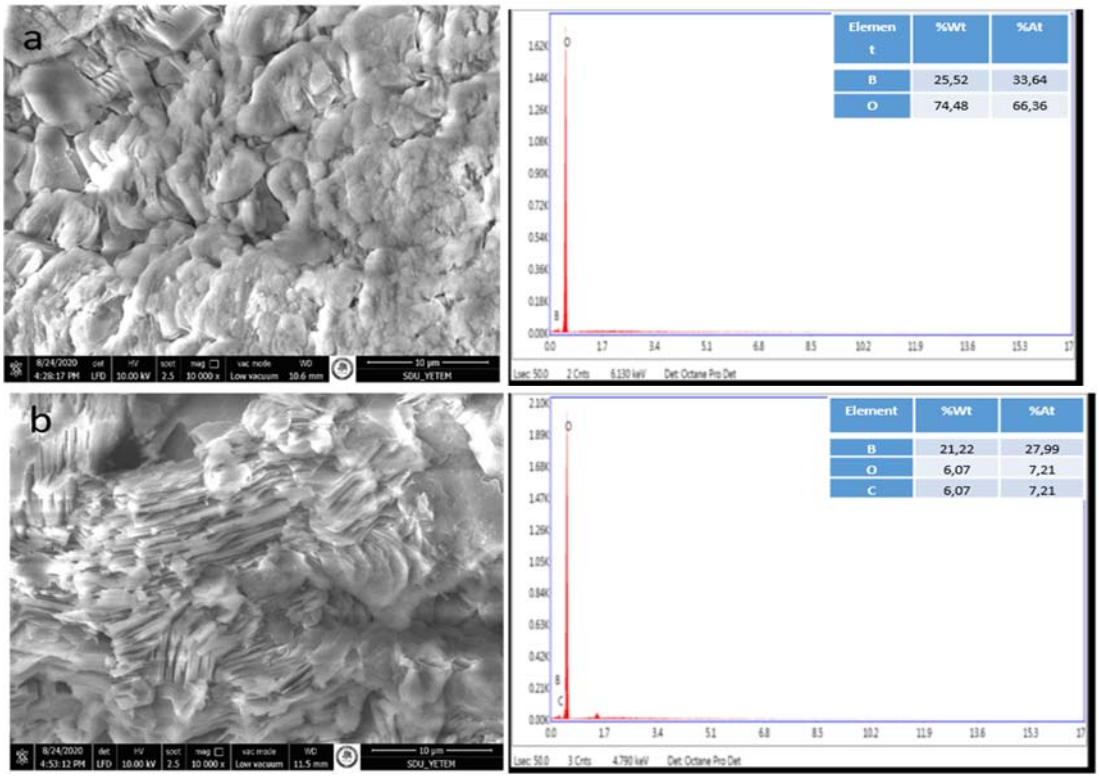

Figure 3. SEM/EDS Results of a) H_3BO_3 and b) H_3BO_3 doped GO

4. Discussion and Conclusions

We developed an improved Hummers method without using $NaNO_3$ for the synthesis of GO. This improved method eliminates the generation of toxic gasses. The improved Hummers method described here can be used to prepare GO in large scale and it is one-step towards the synthesis of graphene and its derivatives through environmentally friendly. Then we aimed to observe the graphene oxide doped boron synthesis and SEM/EDS analysis evidenced the GO doping.

Acknowledgements

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Effects of Different Dopants on The Conductivity of Tin Oxide Thin Layered Conductive Glass

Kamila Sobkowiak[1*], Mustafa Karaboyacı[2]

Abstract: The aim of the study was the evaluation of conductive properties of variously doped tin oxide and zinc oxide thin layered conductive glasses. Dye-sensitized solar cells have been extensively researched in recent years with the idea that they will be a promising source of energy in the future, due to their low cost, efficiency in low light conditions and absorption on the visible light spectrum. In this study, the conductive glass part of the cell was produced with among others sodium and bismuth-doped SnO_2 nano coating by spray pyrolysis method. The performance and efficiency of the solar cells was measured. Properties of KBr and KI – doped glass were the most satisfying and were assumed to be accurate in fulfilling the role of efficient and effective dye-sensitized solar cell.

Keywords: dye sensitized solar cells, transparent conductive glass, spray pyrolysis, doped SnO_2 thin films

1. Introduction

Solar energy is the main renewable energy source available today because it provides energy for growth and development to all living beings in the world through the process of photosynthesis. (Kumar et al. 2015) An important advantage of solar energy is that it can be used locally and commercially. Solar energy benefits not only the individual owners but also the environment. This energy can be turned into useful heat or electricity. Electricity is a form of energy that can be made accessible easily. For this reason, scientists and engineers are currently trying to use solar radiation to generate electricity directly with economic devices. (Dias, 2015)

The dye-sensitized solar cells (DSSC) have attracted great attention in the last two decades due to their environmentally friendly production, low production costs, ease of production, adjustable optical properties such as color and transparency. (Gong et al. 2012) Dye-sensitized solar cells provide high conversion efficiency and are known as third generation solar cells. Generally, a DSSC consists of a nanocrystalline semiconductor film electrode modified with a dye, a platinum (Pt) counter electrode, and an electrolyte solution between the electrodes (anode and cathode). (Can & Karaboyaci, 2019, Feldt, 2013)

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2. Material and Method

Material used:

- Tin (II) chloride dihydrate ($SnCl_2 * 2H_2O$) – Merck
- Ammonium fluoride (NH_4F) - Sigma – Aldrich
- Sodium chloride (NaCl) – Merck
- Sodium nitrate ($NaNO_3$) – Merck
- Iodine (I_2) – Merck
- Potassium iodide (KI) – Merck
- Potassium bromide (KBr) – Merck
- Lithium tetraborate ($Li_2B_4O_7$) – Merck
- Bismuth (III) nitrate ($Bi(NO_3)_3$) – Merck
- Cobalt (II) nitrate ($Co(NO_3)_2$) – Merck
- Ethanol (C_2H_5OH) – Merck
- Methanol (CH_3OH) – Merck
- Distilled Water

2.1. Preparation of the conductive glasses

The metal oxide ($SnCl_2*2H_2O$) was dissolved in ethanol or methanol. For some samples doping was performed. Solutions were mixed and heated (50°C/80°C) for 1 hour, filtered if necessary. Films were produced by spraying various amounts of solutions on the glass substrate (5 cm x 5 cm) using the air-brush spray technique. Spray pyrolysis was performed in 600°C. After placing every 1 ml or 5 ml of solution, resistance was measured with the multimeter. After the spray pyrolysis process samples were places in the oven in order to obtain stability. Samples were heated for 4 h. Many combinations of chemicals were tested in different spraying distance and volume, various dopants as well as diverse amounts and types of solvents as described below.

Doping:

- Na: NaCl, $NaNO_3$
- I: KI, I_2
- Co: $Co(NO_3)_2$
- Li: $Li_2B_4O_7$
- Br: KBr
- Bi: $Bi(NO_3)_3$

3. Results

3.1. Dopant-free SnO_2 thin films

Effect of spraying distance was studied.

Molarity $SnCl_2$ [M]	Solvent	Volume [ml]	Resistance [Ω]	Note
0.5	EtOH	15	5.96 kΩ	5 cm
0.5	EtOH	20	2500 kΩ	15 cm

Table 1. Measurements of dopant-free SnO_2 thin film

3.2. Doped SnO_2 thin films

Effect of various doping and dopant amounts was studied.

Molarity $SnCl_2$ [M]	Doping substance	Doping	$SnCL_2$ g x %10	Solvent	Volume [ml]	Resistance [Ω]	Note
1	NaCl	Na	1%	EtOH	20	3878 kΩ	-
1	NaCl	Na	1%	MeOH	20	160 kΩ	800C 30 min
0.5	NaCl	Na	5%	MeOH	20	614 kΩ	$SnCl_2$ baked 800C 30 min
0.5	$NaNO_3$ NaCl	Na	10%	EtOH	10 each	0	800C 30 min
0.5	$Co(NO_3)_2$	Co	5%	EtOH	15	6100 kΩ	-
0.5	$Bi(NO_3)_3$	Bi	2%	EtOH	20	?	-
0.5	$Bi(NO_3)_3$	Bi	5%	EtOH	20	0	-
0.5	$Bi(NO_3)_3$	Bi	8%	EtOH	10	?	800 C 10 min
0.5	KBr	Br	5%	EtOH	15	2.4 kΩ	-
0.5	$Li_2B_4O_7$	Li	5%	EtOH	10	17.2 kΩ	-
0.5	KI	I	5%	EtOH	10	4,76 kΩ	-
0.5	I_2	I	1%	EtOH	7	2222 kΩ	-
0.5	I_2	I	10%	EtOH	10	763 kΩ	-

Table 2. Measurements of doped SnO_2 thin films

4. Discussion and Conclusions

In the first experiment the influence of the distance between surface and air – brush was investigated. As seen in the Table 1., the shorter the distance, the lower the resistance.

In the second study, various doping effect was examined. On the basis of the Table 2. we can state that:

1. For Na doping, methyl alcohol as a solvent is more successful.
2. Bi doping is not successful.
3. KBr and KI are the most suitable dopants.
4. Doping with I using I_2 is worse than using KI.

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A New Software Solution Approach for Smartphones in Technology Addiction

Remzi Gürfidan[1*]

Abstract: In the world community, smartphones have rapidly become widespread, surpassing all other portable digital devices in history. In the process of usage and expansion of this product, which has such a large user base in the society, as well as many of its convenience, the negative situations it creates are identified. At the heart of the concept of "Technology Addiction," which has been particularly striking in recent years, lies the uncontrolled and unconscious use of smartphones. This study was carried out to propose a software solution approach developed for mobile devices to the problem of increasingly widespread technological dependence. Android-based mobile software is an application that can be managed from a central system other than the self-control of its users and is planned to produce solutions to problem scenarios. This application developed is named" technology smart timing application-TAZU".

Keywords: Technology addiction, Android software, Mobile Programming

Teknoloji Bağımlılığında Akıllı Telefonlar İçin Yeni Bir Yazılım Çözümü Yaklaşımı

Öz: Dünya topluluğunda, akıllı telefonlar tarihteki diğer tüm taşınabilir dijital cihazları geride bırakarak hızla yaygınlaştı. Toplumda böylesine geniş bir kullanıcı kitlesine sahip olan bu ürünün kullanım ve yaygınlaşma sürecinde, pek çok kolaylığının yanı sıra, yarattığı olumsuz durumlar tespit edilmektedir. Son yıllarda özellikle dikkat çeken "Teknoloji Bağımlılığı" kavramının merkezinde akıllı telefonların kontrolsüz ve bilinçsiz kullanımı yatıyor. Bu çalışma, giderek yaygınlaşan teknolojik bağımlılık sorununa mobil cihazlar için geliştirilmiş bir yazılım çözümü yaklaşımı önermek amacıyla yapılmıştır. Android tabanlı mobil yazılım, kullanıcılarının öz kontrolü dışında merkezi bir sistemden yönetilebilen ve problem senaryolarına çözüm üretmesi planlanan bir uygulamadır. Geliştirilen bu uygulama "teknoloji akıllı zamanlama uygulaması-TAZU" olarak adlandırılmıştır.

Anahtar Kelimeler: Teknoloji bağımlılığı, Android yazılımı, Mobil Programlama

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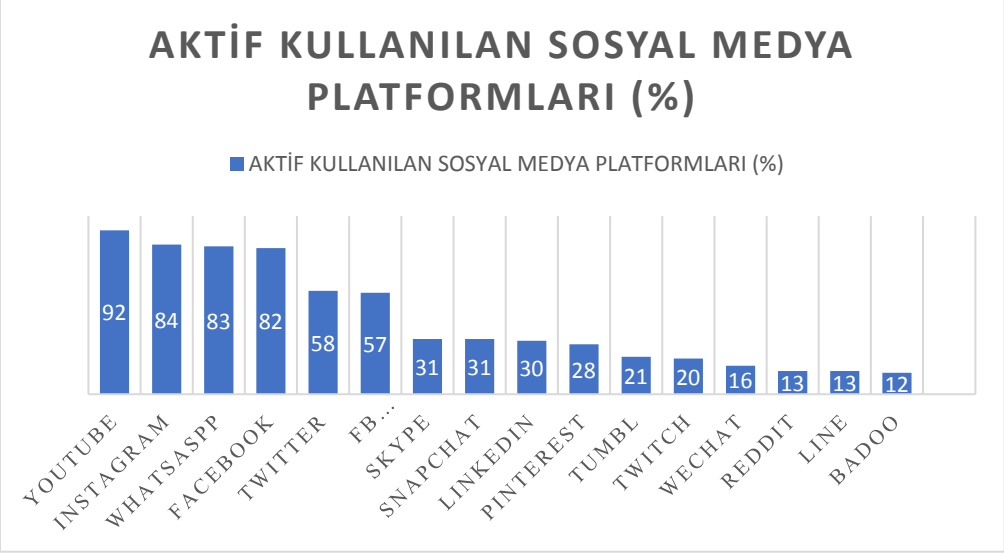
1. Giriş

Son çeyrek yüzyılda hızla gelişen elektronik ve yazılım endüstrileri, günlük yaşamda kullanılan materyallerin geliştirilmesinde önemli bir role sahiptir. İnternetin kolay ulaşılır hale gelmesi ile birlikte iletişim, alışveriş, iş, eğlence gibi birçok alanda kullandığımız akıllı telefonlar bu iki endüstriden doğan çok yönlü bir ürün olarak değerlendirilebilir. Dünya toplumunda akıllı telefonlar hızla yaygınlaşarak tarihteki tüm diğer taşınabilir dijital cihazları geride bırakmıştır [1]. Farklı özellik ve fiyatlarla donatılarak kullanıcıları ile buluşması kolaylaştırılan bu teknolojik ürün, günümüzde 5,11 milyar benzersiz kullanıcı portföyüne sahiptir [2]. Tüm dünyada olduğu gibi ülkemizde de akıllı telefon kullanıcı sayısı yıllara göre artmakta ve 2019 yılında nüfusun %93'ü yani 76,34 milyon benzersiz birey, mobil telefon kullanıcısı olarak kayıt altına alınmış durumdadır [2,3].

Toplumda bu kadar geniş kullanıcı kitlesine sahip olan bu ürünün kullanım ve yaygınlaşma sürecinde, birçok kolaylığının yanı sıra yarattığı olumsuz durumlar da tespit edilmektedir. Özellikle son yıllarda çarpıcı vakalarla karşımıza çıkan "Teknoloji Bağımlılığı" kavramının temelinde, akıllı telefonların kontrolsüz ve bilinçsiz kullanımı yatmaktadır. Bu yanlış davranışlar, bireylerin sosyalleşme ihtiyaçlarını karşılamadığı gibi sosyalleşme becerilerini körelterek bireyleri yalnızlaştırdığı ileri sürülmektedir [4,5]. Bu konu üzerine yapılan çalışmalarda akıllı telefonların bilinçsiz aşırı kullanımı sonucunda ergenlerin, etrafındaki insanlara ve eşyalara karşı saldırganlık tutumu geliştirdiğine dair bulgular ortaya çıkmıştır [6]. Akademik başarı açısından bu konuya bakıldığında, akıllı telefona bağımlılık düzeyinin öğrencilerin dikkatleri ve davranışlarındaki hiperaktivite bozuklukları üzerinde negatif etkiye sahip olduğu sonucuna varılmıştır [7].

Ülkemizde 2017 yılında 42 milyon olan internet kullanıcı sayısı 2018 yılında 54 milyona ulaşmış ve 2019 yılında ise bu rakam 59 milyonu bulmuştur [2]. En çok kullanılan, vakit geçirilen sosyal medya ve sosyal iletişim ortamları Şekil 1'de gösterilmiştir.



Şekil 1. Türkiye'de 2019 yılında en çok kullanılan ve vakit geçirilen sosyal medya platformları

Bu çalışmada gerçekleştirilecek olan mobil yazılımın çözmesini hedeflediğimiz problemler senaryolaştırılmıştır. Geliştirilen çözüm yazılımı farklı senaryolara göre şekillendirilerek söz konusu problemlerin gittikçe azaltılıp ortadan kaldırılabileceği öngörülmüştür.

1.1.Problem Senaryoları

- Ders sürecinde dersin hem öğrenci hem eğitici açısından verimli geçmesi önemlidir. Eğitim paydaşlarının ders saatleri süresince hem öğrencilere hem eğitmenlere ait akıllı telefonların, uygulama ile aktif kullanılır halden çıkartılması konsantrasyonu bozucu, dikkat dağıtıcı etkenlerden arındırılması anlamında yaşanabilecek problemleri önleyici durumundadır. Bunun yanında yasal olmayan görüntü ve ses kaydı alma durumları yaşanabilecek potansiyel problemlerdendir. Gün içerisinde akıllı telefonlardan uzak kalan öğrencilerin, bilinçsiz internet kullanımı kısıtlanan öğrencilerin, akademik anlamda daha başarılı olduğu yapılan çalışmalarda da ispatlanmıştır [8,9]. Ders esnasında akıllı telefonları ile vakit geçiren öğrencilerin akademik başarı anlamında diğer arkadaşlarından düşük dereceye sahip oldukları yapılan çalışmalar ile kanıtlanmıştır [10].

- İbadethanelerde geçirilen sürelerde akıllı telefonun aktif kullanılır durumda olması ortamın doğasına aykırıdır. İbadethanelerde toplu veya bireysel eylemlerin gerçekleştiği süreler içerisinde akıllı telefonun kullanılabilirliği yaşanabilecek olan problemlerdendir.

- Kütüphane ortamları sükûnetin sağlanması gereken mekanlardır. Bu alanlar dahilinde telefonla konuşulması, ortamda çalışanların konsantrasyonunu olumsuz etkileyecektir.

- Askeri birliklerde eğitim saatleri içerisinde er, erbaş ve komutanların akıllı telefonlara erişimler ve kullanımları yasaklanmıştır. Gizlilik içeren askeri birlikler de akıllı telefonların kullanımının kısıtlanma sebeplerinden bir tanesi de görüntü ve ses kayıtlarını engelleyebilmektir.

- Özel sektör çalışanları, mesai saatleri içerisinde akıllı telefonlar ile geçirdikleri vakit yüzünden işlerini aksatabilmektedir. Bu durum işveren tarafından hoş karşılanmamakta ve çalışanlar ciddi problemlere neden olmaktadır. Özellikle iş güvenliğinin üst derece önemli olduğu iş kollarında akıllı telefonlar iş görenlerin iş ciddiyetini ve dikkatini bozarak iş kazalarına sebep olabilmektedir.

- Konferans, toplantı gibi kalabalık katılımcıların olduğu etkinliklerde, yapılan etkinlikten verim alma adına iş ciddiyeti önemli bir faktördür. İş akışının bozulması, konuşmacının dikkatinin dağılması, uzun süren etkinliklerde daha kolay olmaktadır. Bu anlarda çok büyük bir kitle akıllı telefonları ile etkileşim içerisine girerek diğer katılımcıların ya da konuşmacının motivasyonunu olumsuz etkileyebilmektedir.

- Özel güvenlik büroları, makam odaları gibi alanlarda güvenlik ihlalleri önemli bir problemdir. Davetlilerin ses ve görüntü kaydı gibi istenmeyen eylemlerde bulunması problemin odak noktasıdır.

- Araç kullanımı esnasında akıllı telefonlar ile ilgilenmek dikkat dağılımına sebep olarak trafik kazalarında can ve mal kayıplarına neden olmaktadır [11]. Yasalar ile bu davranışa

ceza hükümleri getirilmiş olsa da teknolojiye olan bağımlılık bireyleri öz denetimli olmaktan alıkoymaktadır.

- Akıllı telefon kullanım yaşı günümüzde hızla düşmektedir. Ebeveynler çocuklarının mutsuz ya da huysuz olduğu zamanlarda, çocukların ilgisini çekebilecek videoları bu cihazlardan açarak farkında olmadan çocuklarını teknolojiye bağımlı hale getirmektedir. Hatta birçok ebeveyn yemek yerken, tırnak keserken, üzerini giydirirken o kadar çok bu yönteme başvurmuşlardır ki artık bu cihaz olmadan bahsedilen eylemlerini yerine getirmek mümkün olmamaktadır. Bu tarz durumlara maruz kalan çocuklar günün diğer zamanlarında da akıllı telefonların ve internetin derin dünyasında kaybolup uzun zaman geçirmektedirler. Tam olarak bu durum çocukların ruhsal ve bedensel gelişimleri açısından istenmeyen sonuçlar doğurmakta, görme bozuklukları sosyalleşme problemleri gibi birçok probleme sebep olmaktadır. GFK ve Digital Talks'ın araştırmasına göre Türkiye'de 6-15 yaş grubundaki çocukların yüzde 59'unda akıllı telefon, yüzde 42'sinde tablet ve yüzde 44'ünde bilgisayar bulunmaktadır [12]. Bu denli yaygınlaşan akıllı telefonları çocukların elinden almak, çocuk kilidi gibi yollara başvurmak probleme çözüm getirme de yetersiz kalmaktadır.

2. Literatür Çalışması

İnternet kullanımının ve akıllı cihazların yaygınlaşması ile birlikte teknoloji bağımlılığının olumsuz etkileri belirgin şekilde ortaya çıkmaktadır. Bilinçsiz teknoloji kullanımının sebep olduğu teknoloji bağımlılığının nomofobi, netlessfobi, fomo gibi farklı psikolojik rahatsızlıklara neden olduğu bilimsel çalışmalarla da ortaya konmuştur [13]. Teknoloji bağımlılığı konusu ile yapılan çalışmalar araştırıldığında literatürde birçok çalışma karşımıza çıkmaktadır. Yapılan çalışmalar genellikle teknoloji bağımlılığı ile bir değişkenin ilişkisinin incelenmesi [14-16], yaş gruplarına göre teknoloji bağımlılığının incelenmesi [17-21] ya da teknoloji bağımlılığı ile ilgili ölçek geliştirme [22-24] üzerinedir. Bunun yanında sayısı az da olsa teknoloji bağımlılığını ortadan kaldırma ya da tedavi etme üzerine yapılan çalışmalarda mevcuttur.

Arısoy teknoloji bağımlılığının tıbbi tedavi yöntemlerine önerilerde bulunmuştur. Farmakoterapi yaklaşımında hastanın bu bağımlılık sebebinin bir başka psikolojik rahatsızlıktan kaynaklandığının tespiti üzerine durmuştur. Bu bağımlılığı tetikleyen gerçek psikolojik rahatsızlığın tespit edilip tedavi edilmesi halinde teknoloji bağımlılığının da ortadan kalkacağını öngörmüştür. Farmakoterapi yaklaşımının ikinci dalında patolojik internet kullanımı bir diğer psikiyatrik bozukluğun belirtisi değil ise dürtü kontrol bozukluğu ve bipolar duygudurum bozukluğuna daha yakın olması sebebiyle seçilecek olan farmakoterapinin her iki bozuklukta da kullanılan duygudurum dengeleyicisi önerilmektedir. Arısoy'un internet bağımlılığının tedavisinde bir diğer seçenek; farmakoterapiye ek olarak ya da farmakoterapiden bağımsız olarak bilişsel-davranışçı yöntemlerin kullanılmasıdır. Bu yöntemde bireyin davranışlarının tespit edilmesi önceliklidir. Daha sonrasında internetten uzak kalıp kalamadığının tespit edilmesi, akıllı cihazının yerinin değiştirilmesi, kalabalık grıplarla internete bağlanması, internete bağlanma zamanının değiştirilmesi, spor aktiviteleri, yeni sosyal beceriler kazandırılması, aile terapisi gibi adımlar bulunmaktadır [25].

Ertemel ve Aydın çalışmalarında bağımlılıktan kurtulma çözümünü, bireysel, aile, kurum ve toplum temelli yaklaşımlar üzerine yapılandırmışlardır. Bireysel çözüm önerilerinde sosyal medya, mobil oyunlar vb. ürünlerin tüketimini arttıran kanca yönteminden kurtulma yollarından bahsedilmektedir. Bunun için akıllı cihazların bildirimlerinin tümüyle kapatılması, sosyal medya, oyun gibi uygulamalara giriş imgelerinin iç klasörlere taşınması, uygulamadan çıkışların oturumları her seferinde sonlandırılarak yapılması ve tekrar girişlerde tekrar kullanıcı adı ve şifre girişine zorlanacak biçimde bulunulması gibi tavsiyelerde bulunmaktadır. Bu yönteme ek olarak kendiliğinden internet bağlantısını kesen, uygulamaya girişi kasıtlı olarak geciktiren dikkat koruyucu uygulamaların kullanımı da tavsiye etmektedir. Aile yaklaşımında ise ebeveynlerin birbiri ile ilgilenmeleri gerektiğinin vurgusunu yaparak, akıllı telefonların mecra ya da uygulama bazlı kısıtlayabilen uygulamaların kullanımını tavsiye etmektedir. Kurum bazında yöneticilerin toplantı esnasında akıllı cihazlardan uzak durarak örnek model oluşturması, öğrencilerin ders dışı aktivitelere yönlendirilmesi üzerine tavsiyelerde bulunulmuştur. Toplumsal yönüyle alınabilecek önlemlerde ise dumansız hava sahası temsili gibi akıllı cihazların olmadığı alanların oluşturulabileceği, kamu spotları ile toplumun bilinçlendirilmesi gerekliliği üzerine tavsiyelerde bulunmaktadır [26].

Space mobil uygulaması telefonunuzun kilidini kaç kere açıp kapattığınızdan, uygulamalarda ne kadar vakit harcadığınıza tüm kullanımınızı takip ederek grafiksel ara yüz üzerinde sunar. Uygulama da ekran karartma, bildirim engelleyici gibi seçenekler sunarak telefondan uzak durmanız hedeflenir. Önerileri dikkate alarak akıllı telefonunuzdan yeterince uzak durmayı başarırsanız rozet gibi çeşitli simgesel ödüllendirmeler kazanırsınız. Uygulamanın kontrolü tamamen kullanıcı tarafından planlanmaktadır.

Forest mobil uygulaması da kullanıcı tarafından belirli bir süre girişi yapıldıktan sonra, o süre boyunca telefona dokunulmadığı süre içerisinde orman ve ağaç simülasyonları ile yavaş yavaş yeşil bir topluluk oluşmasını simüle eder. Bu süre zarfında telefona dokunulursa uyarılar vererek oluşan ormanlık kurutulmaya başlanır. Bu sanal işlemler mobil uygulamada üst paket satın alındığı taktirde Trees for the Future ortaklığı ile gerçek hayata dönüştürülür. Telefondan uzak kaldığınız süre zarfında yetişen ağaç sayısı kadar gerçek dünyada ağaç diktirmiş olabilirsiniz.

Modemlerin bağlı bulunduğu prizlere zaman ayarlı prizler takılarak internetin belirli aralıklarda devre dışı bırakılarak kişilerin dikkatinin internete bağlı teknolojik ürünlerden dağıtılması hedeflenmiştir.

3. Önerilen Model

Bu çalışmada gerçekleştirilen android tabanlı mobil yazılım, kullanıcılarının öz denetimi dışında merkezi bir sistemden yönetilebilen, problem senaryolarına çözüm üretmesi planlanan bir uygulamadır. Geliştirilen bu uygulamaya "Teknolojiyi Akıllı Zamanlama Uygulaması-TAZU" ismi verilmiştir. Bu uygulamanın amaçlarından biri öğrenci ve eğitmenlerin ders esnasında, akıllı cep telefonlarının olumsuz yönlerinin (internet, oyun, -video-ses-resim paylaşımı, kopya vs.) bertaraf edilmesi ve derste dikkatin bu cihazlara yönelmesini engellemek, eğitimciler ile öğrenciler arasında oluşabilecek sorunların önüne geçmektir. Bir diğer amaç ise

öğrencilerin okul dışı süreçlerinde ve küçük yaş gruplarının günlük hayatında, akıllı cihazlara erişim süresinin kontrol altına alınmasıdır.

Geliştirilen uygulamayı iki basamakta incelenmelidir. Birinci basamak öğrenci ve öğretmen ve küçük yaş gruplarının telefonlarında çalışan Android uygulamasıdır. İkinci basmamak, akıllı cihazlarda uygulamanın yönetimi ve takibi için oluşturulan web tabanlı yönetim panelidir. Öncelikli olarak Android uygulaması, ardından web yönetim paneli geliştirilmiştir.

3.1.Mobil Yazılım Uygulaması

Mobil uygulamanın tasarımı ve kodlaması Android Studio 2.3.3. versiyonunda gerçekleştirilmiştir. Uygulamanın kodlamasında Java programlama dili kullanılmıştır. Mobil uygulamadaki veriler dosyalama yöntemi ile saklanmaktadır.

Mobil uygulama akıllı cihaza yüklendiği anda kullanıcı adı ve parola bilgileri girilerek uygulama ayarlarının yapıldığı forma geçilir. Şekil 2'de uygulamaya giriş ekranı ve çalışma kategori seçimi ekranı gösterilmektedir.

Şekil 2. Uygulamanın Giriş Paneli ve Kategori Seçim Paneli

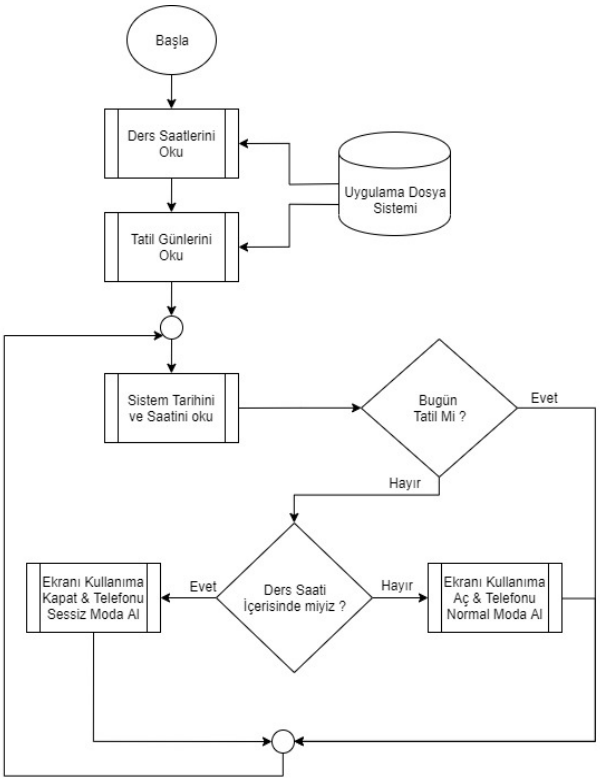
Kategori seçimi panelindeki "Eğitim Ortamı" seçeneği tıklandığında, kullanıcıdan uygulamanın aktif edileceği saat aralıkları Şekil 3'te görülen forma girilmesi istenecektir. Bunun yanında uygulamanın ekranı kilitlemeyeceği tatil günlerinin tarih girişleri de Şekil 3'te gösterilen forma girilebilmektedir. Giriş saatleri ve tarihleri tamamlandıktan sonra "Kaydet" butonuna basılarak bilgiler kaydedilir.

Şekil 3. Uygulamanın Tarih ve Saat Bilgileri Ayarlama Formları

Kategori seçimi panelindeki “Küçük Yaş Grupları” seçeneği tıklandığında, kullanıcıdan uygulamanın kullanıcıya kulanım izni vereceği saat aralıklarını Şekil 4’te görülen forma girilmesi istenecektir.

Şekil 4. Uygulamanın Küçük Yaş Grupları Kategorisi Çalışma Saatleri Ayarlama Formu

Tüm ayarlamalar tamamlandığında uygulama otomatik olarak devreye girmektedir. Uygulamaya girişi yapılan tarih ve süre kısıtları gerçekleştiğinde, akıllı cihazın ekranına yarı şeffaf bir form açılarak cihaz ekranını ve düğmelerini dokunmaya karşı duyarsız hale gelmekte ve telefonu sessiz moda geçmektedir. Açılan yarı şeffaf form yazılımsal olarak önceliği en üst düzeyde olacak şekilde ayarlanmıştır. Böylece bu form kapanmadan herhangi bir işlem gerçekleştirilememektedir. Tasarlanan bu sistemde öncelikle yazılımsal olarak bir BroadCast sınıfından bir nesne oluşturulmuş ve bu nesne ile akıllı cihazın yeniden başlatılması olayı dinlenmiştir. Oluşturulan nesne, sürekli olarak arka planda çalışacak olan servisi başlatmaktadır. Servis ise bir zamanlayıcı tetiklemekte ve zamanlayıcı, periyodik olarak sistem tarihini ve saatini alıp, dosyalarda kayıtlı olan saat ve tatil bilgileriyle karşılaştırmaktadır. Buna göre ekran kilitlenmesine ya da açılmasına karar verilmektedir. Servis, ekranı kilitlemek için, hiçbir şekilde kapatılamayan, daima üstte kalan ve dokunmaya duyarsız yarı şeffaf bir form oluşturmaktadır. Akıllı cihaz kapatılıp tekrar açılsa bile servis otomatik olarak başlamakta ve kısıtlanan tarih ve saate gelinip gelinmediğini sürekli kontrol etmektedir. Uygulama içerisinde arka planda sürekli çalışan servisin akış diyagramı şekil 5’te gösterilmektedir.



Şekil 5. Arka planda çalışan servisin akış diyagramı

Geliştirilen uygulama, kullanıcının akıllı cihazı kullanımını kısıtladığı durumlarda dahi, telefonun erişilebilirliği ile ilgili bir işlem yapmamaktadır. Telefonlar için dışarıdan aramalar görüntülenebilmekte fakat cevaplanamamaktadır. Benzer şekilde mesaj ve diğer uygulamaların bildirimleri alınabilmekte fakat görüntülenip cevap verilememektedir.

Şekil 6. TAZU'nun akıllı cihazı kullanımı kısıtlama ekranı

Öğrencinin veya eğitmenin okula gelmediği günler düşünülerek uygulamada yazılımsal çözümler geliştirilmiştir. Geliştirilen uygulama okul çevresi dışarısında aktif olarak çalışmamaktadır. Uygulama wifi özelliğini otomatik olarak aktif hale getirmektedir. Wifi özelliği kullanıcı tarafından kapatılsa bile uygulama tekrar bu özelliği başlatmaktadır. Sonrasında wifi listesi uygulama tarafından kontrol edilip kullanıcının ait olduğu eğitim kurumunun ağına rastlandığında kullanıcının eğitim kurumunda olduğu anlaşılmaktadır. Bu

duruma göre uygulamanın aktif çalışıp çalışmayacağı belirlenmektedir. Kullanıcının tabi olduğu eğitim kurumu ağının ismi "@fatih" olarak Millî Eğitim Bakanlığı tarafından belirlenmiştir ve bu her eğitim kurumu için aynı olup değiştirilememektedir.

Geliştirilen uygulama kullanıcı tarafından akıllı cihazlardan kaldırılabilir ya da cihazın saati değiştirilebilir. Bu durum geliştirilen uygulamanın zayıf yönlerindendir. Bu zafiyete çözüm olarak geliştirilen bir web ara yüzü sayesinde mobil uygulamanın kurulu olduğu akıllı cihazda, yazılımın aktif çalışıp çalışmadığı kontrol edilebilmektedir. Bunu gerçekleştirebilmek için uygulama gün boyunca ekranın kaç kez kapatıldığını saymaktadır. Gün sonunda bu veriler veri tabanına gönderilip, kayıt altına alınarak web sayfasında gösterilmektedir. Küçük yaş grupları kategorisi için de kullanıcının gün içerisinde akıllı cihazı kullandığı süreler toplamı gün sonunda veri tabanına gönderilmektedir. Bu sayede uygulamanın kurulu olduğu akıllı cihazlar kolaylıkla tespit ve takip edilebilmektedir.

4. Sonuçlar

Bu çalışmada teknolojik bağımlılığı sorununa çözüm olabilecek bir mobil uygulama gerçekleştirilmiştir. Gerçekleştirilen android tabanlı mobil yazılım, kullanıcılarının öz denetimi dışında merkezi bir sistemden yönetilebilen, problem senaryolarına çözüm üretmesi planlanan bir uygulamadır. Sunulan çözüm temel anlamda cihazın aktif çalışır halde olmasına rağmen işlevlerini yerine getirmesine engel olmaktadır. Gerçekleştirilen yazılım içerisinde acil durumlar için ve cihaz rehberinden seçilmiş 3 kişi için istisna imtiyazlar bulunmaktadır.

Teknoloji bağımlılığı problemine gerçek çözümün eğitim ve bilgilendirme kanalları vasıtası ile bireylerde teknolojiyi doğru kullanma ve bilinçlendirme çalışmaları ile sağlanacağına inanıyoruz. Fakat çalışma içerisinde verilen vaka sayıları göz önüne alınırsa mevcut durumun kriz anında müdahale niteliğinde olduğu söylenebilir. Önerilen yazılımsal çözüm, toplum doğru teknoloji kullanımını öğrenip bilinçlendirilene kadar kullanılabilir bir alternatif çözüm yolu sunmaktadır.

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Utilization of waste aluminum parts generated during CNC production as fiber in cement paste / CNC üretimi sırasında açığa çıkan atık alüminyum parçaların çimento hamurunda lif olarak değerlendirilmesi

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Abstract: In this study, the use of waste aluminum particles released by CNC production technique used in processing aluminum materials as fiber substitute in cement paste was investigated. In this context, reference and aluminum waste incorporating specimens were produced, and the mechanical performances of the specimens were obtained by three-point bending and compression tests. When the data obtained were evaluated, with the addition of waste aluminum, flexural strength was increased from 1.14 MPa to 1.51 MPa (32%); deflection capacity was increased from 0.07 mm to 0.13 mm (86%). It was also determined that the energy absorption capacity of the sample increased from 9.11 N.mm to 32.78 N.mm (259%) without losing its load bearing capacity, and to 84.13 N.mm (823%) in case of controlled crack opening. The compressive strength of specimens decreased by approximately 11% from 22.87 MPa to 20.30 MPa. In conclusion, it has been observed that the bending and energy absorption capability of a brittle cement-based material can be improved by using unprocessed aluminum waste supplied as waste as fiber, and it has been predicted that these wastes have the potential to be recycled and produced as fiber-equivalent reinforcement elements.

Keywords: Aluminum, waste, CNC, cement, bending, compressive.

Özet: Bu çalışmada, alüminyumun malzemelerin işlenmesinde kullanılan CNC üretim tekniği ile açığa çıkan atık alüminyum parçacıkların çimento hamurunda lif muadili olarak kullanılabilirliği araştırılmıştır. Bu kapsamda, referans ve alüminyum atık içeren numuneler üretilmiş ve numunelerin mekanik performansları üç noktalı eğilme ve basınç testleri ile elde edilmiştir. Elde edilen veriler değerlendirildiğinde, atık alüminyum ilavesiyle numune eğilme dayanımnın ortalama 1.14 MPa'dan 1.51 MPa mertebelerine (%32); sehim kapasitesinin 0.07 mm'den 0.13 mm'ye (%86) oranında arttığı belirlenmiştir. Numune enerji yutma kapasitesinin, yük taşıma kapasitesini kaybetmeden 9.11 N.mm mertebelerinden 32.78 N.mm mertebelerine (%259), kontrollü çatlak açılması durumunda ise 84.13 N.mm mertebelerine (%823) yükseldiği tespit edilmiştir. Basınç dayanımının ise yaklaşık %11 oranında azalarak 22.87 MPa'dan 20.30 MPa seviyelerinde olduğu tespit edilmiştir. Sonuç olarak, atık halde temin edilen işlenmemiş alüminyum atığının lif muadili olarak kullanılmasıyla kırılgan yapıdaki bir çimento esaslı malzemenin eğilme ve enerji sönümleme yeteneğinin geliştirilebildiği görülmüş ve söz konusu atıkların, geri dönüşümle yeniden kazandırılarak lif muadili güçlendirme elemanı olarak üretilme potansiyelinin bulunduğu öngörülmüştür.

Anahtar Kelimeler: Alüminyum, atık, CNC, çimento, eğilme, basınç

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1. Giriş

Beton günümüzde en yaygın olarak kullanılan yapı malzemesidir. Ancak betonun en önemli dezavantajlarından bir tanesi düşük bir çekme dayanımına ve buna bağlı olarak kırılgan bir yapıya sahip olmasıdır. Bu nedenle, betonun donatılandırılmadan kullanılması neredeyse imkânsızdır. Farklı türdeki malzemelerden üretilen liflerin beton içerisine dahil edilmesiyle, betonun çekme dayanımı, süneklik, darbe direnci vb. gibi özellikleri geliştirilebilmektedir. Bu kapsamda, kullanılan en yaygın malzemelerden bir tanesi de çelik liflerdir. Geçmişten günümüze, çelik lifler kullanılarak yapılan birçok çalışmadan betonun çekme dayanımı, süneklik, enerji yutma kapasitesi vb. özellikle başarıyla geliştirilebilmiştir (Singh, 2016).

Alüminyum, çelikten daha hafif, kolay işlenebilen ve korozyona daha dayanıklı bir malzeme olarak kabul edilmektedir. Bu nedenle, birçok sektörde alüminyum kullanımı oldukça yaygındır ve bu durumun bir sonucu olarak oluşan alüminyum atık miktarı da giderek artmaktadır. Uluslararası Alüminyum Enstitüsü, dünyada tahmini 17 milyon ton alüminyum hurda bulunduğu ve bunun 2020 yılına kadar yaklaşık 21 milyona çıkacağını öngörmektedir. Genellikle yeniden kullanılmadan atılan içecek kutuları, yiyecek paketleri, radyatörler, teller ve çeşitli yarı iletken levhalar gibi materyaller atık olarak kolayca temin edilebilmektedir (Sabapathy vd., 2019). Çok sayıda imalat sektöründeki geniş alüminyum alaşım uygulamaları nedeniyle, alüminyumun işlenmesinde farklı yöntemler kullanılmaktadır. Bu yöntemlerden bir tanesi de daha iyi ürün kalitesi, daha düşük işçilik, göreceli olarak düşük üretim maliyeti ve daha yüksek üretim oranı elde etmek için amacıyla kullanlan bilgisayarlı nümerik kontrol (CNC) cihazlarıdır (Niknam vd., 2018). Bu tür imalat işlemleri ise genellikle döküm ağırlığının yaklaşık% 3–5'i kadar talaş şeklinde alüminyum atığı üretmektedir (Abdollahi, 2014). Muwashee vd. (2018) tarafından yapılan bir çalışmada, atık haldeki alüminyum kutular makro boyutlu şerit olacak şekilde kesilerek harç ve beton içerisine lif muadili olarak katılmıştır. Çalışmada, harçların basınç, çekme ve eğilme dayanımlarının sırasıyla %27, %293 ve %296; beton basınç, çekme ve eğilme dayanımının referans betona kıyasla sırasıyla %22, %187 ve %238 oranında arttırdığı görülmüştür. Sabapaty vd. (2019) tarafından yapılan bir çalışmada, farklı dozajlarda alüminyum lif içeren betonların çekme ve eğilme dayanımları incelenmiştir. Çalışmada, basınç dayanımı %11.67'ye kadar, çekme dayanımı ise %36.88'ye kadar arttırılmış ve alüminyum liflerin kullanımıyla beton basınç ve çekme özelliklerinin geliştirilmesinde başarılı bir şekilde kullanılacağını gösterilmiştir.

Bu çalışma kapsamında, CNC üretim tekniği ile açığa çıkan alüminyum atıkların çimento hamuru içerisinde lif muadili olarak kullanılarak eklenmesi ve bu sayede hem çimento hamurunun kırılgan davranışının engellenmesi hem de atık durumdaki alüminyumun alternatif bir güçlendirme elemanı olarak değerlendirilmesi planlanmaktadır.

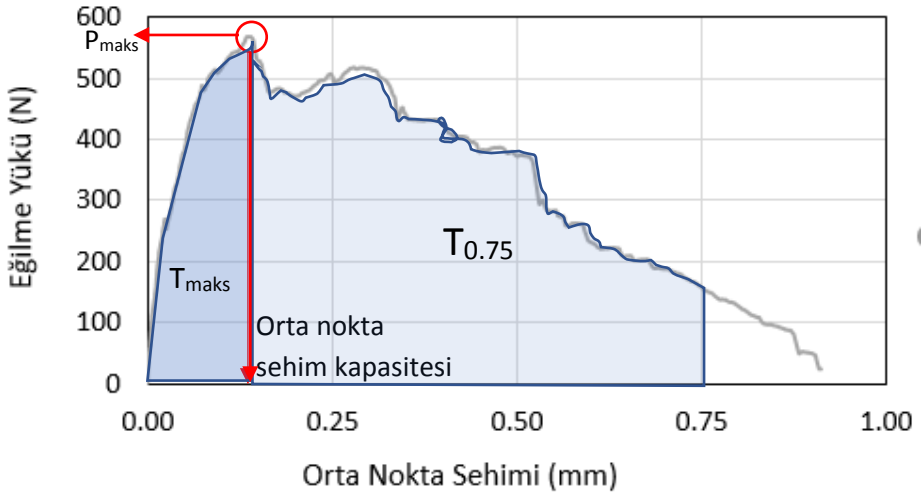
2. Malzeme ve Yöntem

Matris olarak su/çimento oranı 0.50 olacak şekilde bir çimento hamuru hazırlanmıştır. Çimento olarak CEM I 42.5R tipi Portland çimentosu kullanılmıştır. Alüminyum atığı ise CNC tekniğiyle üretim yapan bir firmadan temin edilmiştir. Ancak elde edilen alüminyum atıkları sürekli ve karmaşık bir yapıda olduğundan bir metal makası yardımıyla 3 cm uzunluğa sahip olacak şekilde kırpılmıştır. Kırpılmış haldeki alüminyum atıkları, hamur faz içerisine ağırlıkça 20 kg/m^3 olacak şekilde eklenmiştir (Şekil 1).

(a) (b)

Şekil 1. a) CNC tekniği sırasında açığa çıkan alüminyum atığı, b) Kırpılmış atık alüminyum

Karışımın hazırlanmasında 2 dm^3 hacme sahip laboratuvar tipi bir harç mikseri kullanılmıştır. İlk olarak çimento ve su 2 dk karıştırılarak homojen bir hamur oluşması sağlanmış 3 adet 40x40x160 mm lik numune alınmıştır. Ardından kalan karışıma, alüminyum atıkları eklenerek 2 dk daha karıştırmaya devam edilmiştir. Kalan karışım da 3 adet 40x40x160 mm lik kalıba alınarak numuneler 1 gün kalıpta bekletilmiştir. Kalıptan çıkarılan numuneler, 28 gün su küründe bekletilmiş ardından mekanik performans deneyleri gerçekleştirilmiştir. Numunelerin eğilme dayanımları 3 noktalı eğilme deneyi ile belirlenmiş ardından kırılmış numuneler üzerinde ASTM C349-18 standardına uygun olarak basınç deneyi uygulanmış ve basınç dayanımları elde edilmiştir. Eğilme deneyi sırasında alınan yük ve orta nokta sehim değerleri kullanılarak numunelere ait yük-sehim eğrileri çizdirilmiştir (Şekil 2).



Şekil 2. Örnek yük-sehim eğrisi ve parametrelerin belirlenmesi

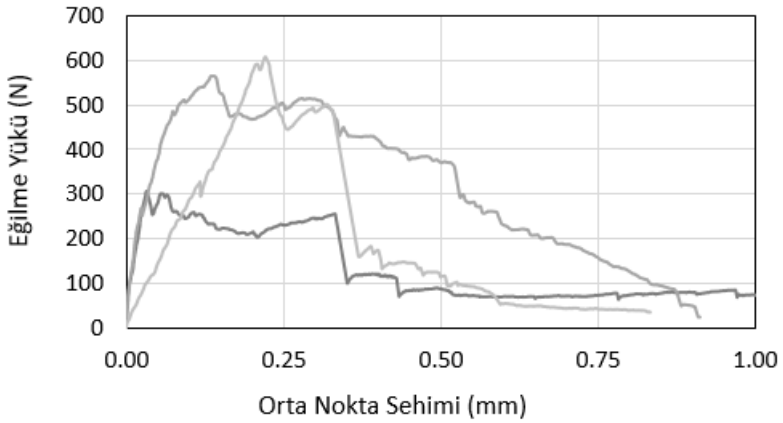
Eğri üzerindeki en yüksek yük değeri (P_{maks}), eğilme dayanımının hesaplanmasında kullanılmıştır (Denklem 1). Burada, L: eğilme yüklemesi sırasındaki mesnetler arası açıklığı, b: numune kesiti taban genişliği ve h: numune kesiti yüksekliğini belirtmektedir.

$$\frac{3}{2}\,x\,\frac{P_{maks}xL}{bxh^2} \qquad \text{(Denklem 1)}$$

Eğilme dayanımına karşılık gelen orta nokta sehim değeri sehim kapasitesi olarak kabul edilmiştir. Numunelerin enerji yutma kapasitelerini değerlendirmek amacıyla iki farklı tokluk hesabı yapılmıştır. İlk olarak orta nokta sehim kapasitesine kadar yük-sehim eğrisi altında kalan hesaplanmış ve T_{maks} olarak adlandırılmıştır. Ancak, lif ve benzeri donatı içeren çimentolu sistemlerde çatlak oluşumundan sonra çatlağın hızlı bir şekilde genişlemesinin engellendiği ve kontrollü bir çatlak açılmasının sağlandığı için hazırlanan numunelerin 0.75 mm orta nokta sehim değerindeki tokluk değerleri de hesaplanmış ve $T_{0.75}$ olarak tanımlanmıştır.

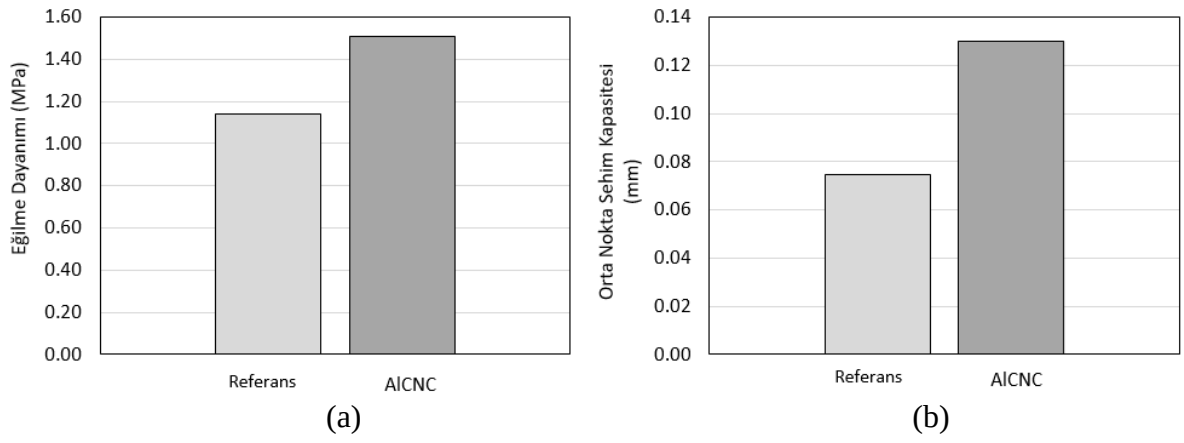
3. Değerlendirme

Numunelere ait yük-sehim eğrileri Şekil 3'te sunulmuştur. Yük-sehim eğrilerine bakıldığında, lif muadili olarak eklenen Al atıkların yükleme süresince oluşan çatlağı köprüleyerek çatlağın kontrollü bir şekilde açılmasının sağlanmasında başarılı olduğu görülmektedir. Buna bağlı olarak, numunenin yük taşıma kapasitesinde de bir miktar artış olduğu görülmektedir.



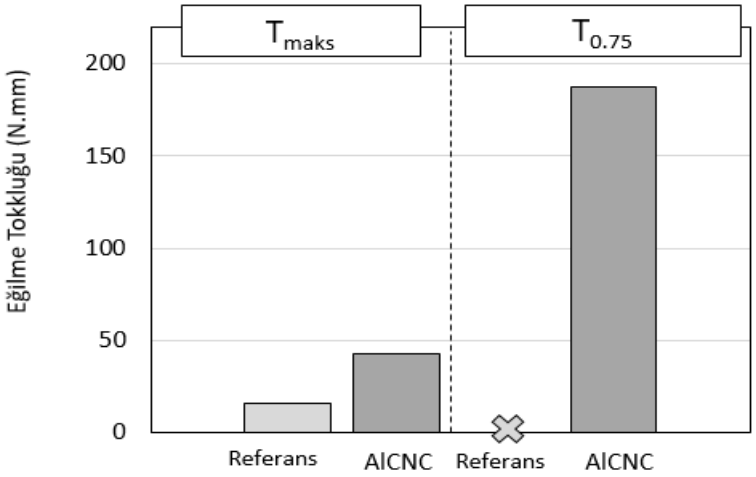
Şekil 3. Numunelerin yük-sehim eğrileri

Hem referans hem de numuneler için elde edilen eğilme dayanımı ve orta nokta sehim kapasitesi değerleri Şekil 4'te sunulmuştur. Atık Al ilavesiyle numunelerin eğilme dayanımları ortalama 1.14 MPa'dan 1.51 MPa mertebeleri yükselmiştir. Söz konusu eğilme dayanımına karşılık gelen sehim kapasiteleri ise sırasıyla 0.07 ve 0.13 olarak belirlenmiştir. Sehim kapasiteleri değerlendirildiğinde, numunelerin deforme olma yeteneğinin yaklaşık 2 kat arttığı söylenebilir.



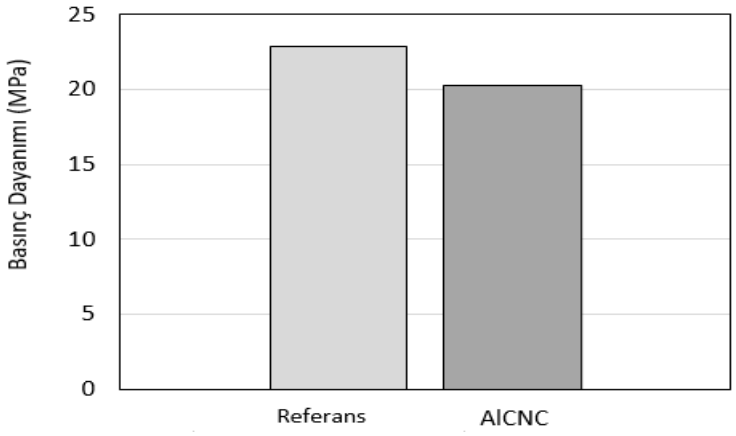
Şekil 4. a) Eğilme Dayanımı, b) Orta nokta sehim kapasitesi

Artan deforme olabilme yeteneğinin sağladığı en büyük avantajın, çimento esaslı malzemelerin yük altında sönümlediği enerji miktarı olduğu söylenebilir. Bu durum, eğilme yüklemesi altında tokluk kavramı ile incelenmektedir. Şekil 5'te, numunelere ait T_{maks} ve $T_{0.75}$ değerleri sunulmuştur. T_{maks} değerleri incelendiğinde, Al ilavesiyle numunelerin maksimum tokluk değerlerinin ortalama 9.11 N.mm mertebelerinden 32.78 N.mm mertebelerine yükseldiği görülmektedir. Ancak, yalnızca en büyük gerilme noktasına karşılık gelen bu değerlerin Al ilavesi yapılan numunelerin kontrollü çatlak genişlemesi yeteneğini tam olarak yansıtmayacağı düşünülmektedir. $T_{0.75}$ parametresi değerlendirildiğinde, numunelerin tokluk değerinin 9.11 N.mm değerlerinden 84.13 N.mm mertebelerine yükseldiği görülmektedir. Bu durum dikkate alınarak, Al atığı ilavesiyle numunelerin enerji yutma kapasitesinin, yük taşıma kapasitesini kaybetmeden %259, kontrollü çatlak açılması durumunda yük taşıma kapasitesi kontrollü olarak kaybettiği durumda ise %823 arttığı söylenebilir.



Şekil 5. Tokluk değerlerinin kıyaslanması

Numunelerin basınç dayanımı performansında meydana gelen değişim Şekil 6'da gösterilmiştir. Atık Al ilavesiyle, artan eğilme performansına rağmen basınç dayanımlarının bir miktar azaldığı görülmektedir. Referans numunelerde basınç dayanımı ortalama 22.87 MPa olarak tespit edilirken, bu değer yaklaşık %11 oranında azalarak 20.30 MPa değerlerine gerilemiştir. Ancak bu gerilemenin, atıl durumdaki bir malzemenin doğrudan işlenmemiş halde kullanılması sonucu ortaya çıkabileceği düşünülmektedir.



Şekil 6. Basınç Dayanımının değişimi

4. Sonuç

Çalışma kapsamında, CNC üretim atığı olarak temin edilen alüminyum parçacıkların çimento hamuruna eklenerek lif muadili olarak kullanılması amaçlanmıştır. Bu kapsamda numuneler üretilmiş ve mekanik performansları eğilme ve basınç deneyleri ile elde edilerek incelenmiştir. Sonuç olarak, atık Al ilavesiyle numunelerin eğilme dayanımlarının ortalama 1.14 MPa'dan 1.51 MPa mertebelerine (%32); sehim kapasitesinin 0.07 mm'den 0.13 mm'ye (%86) oranında arttığı belirlenmiştir. Numunelerin enerji yutma kapasitesinin, yük taşıma kapasitesini kaybetmeden 9.11 N.mm mertebelerinden 32.78 N.mm mertebelerine (%259), kontrollü çatlak açılması durumunda ise 84.13 N.mm mertebelerine (%823) yükseldiği tespit edilmiştir. Ancak basınç dayanımının, 22.87 MPa'dan 20.30 MPa değerlerine (%11) gerilediği görülmüştür. Genel bir değerlendirme yapılacak olursa, atık halde temin edilen işlenmemiş Al atığının lif muadili olarak kullanımında dahi kırılgan yapıdaki bir çimento esaslı malzemenin eğilme ve enerji sönümleme yeteneğinin geliştirilebildiği görülmüştür. Söz konusu atıkların, geri dönüşümle yeniden kazandırılarak, literatürde çelik lif için öngörülen fiziksel özelliklerde üretilmesi durumunda daha iyi hem çekme, hem eğilme hem de basınç mukavemeti açısından daha olumlu mekanik performansların sağlanabileceği düşünülmektedir.

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