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# Outdoor Air Pollution Increased with Urban Transformation in Istanbul Anatolian Side

*Esin Bozkurt*[1]*, *Gussun Gunes*[1]

***Abstract***

*Urban transformation has important impacts on degradation of air quality, while providing the urban growth. Deterioration of air quality not only affects human health but also changes to whole surrounded ecosytems. Many air pollutants are responsible for the degradation of outdoor air quality. Major air pollutants are gasses, chemicals and particulate matters that comes from the burning of fossil fuels. Efforts to improve air quality and reduction of air pollution are important to protect public health. From Marmara Clean Air Centre in Istanbul, air quality parameters affected by urban transformation are evaluated in this study. Measurement values in Istanbul are investigated comparing with thresold limit values of Turkey and World. In 2013 and 2014, $PM_{10}$, $PM_{2.5}$, $SO_2$, $NO_2$ outdoor values in Uskudar and Umraniye are analyzed especially related to growing impacts of urban transformation on the Anatolian side. Data over the period March 1, 2013 - December 1, 2014 is analyzed related to public health. Suggestions are made for improving air quality. If people aware that quality of air in their space affects their health, they can prevent pollution by saving energy, reducing the air pollution of their cars, recycling etc..*

**Keywords**: *$NO_2$, Outdoor Air Quality, Particulate matter, $SO_2$*

## 1. INTRODUCTION

Air pollution has become a major health problem with the industrial revolution. In the early twenty century, amount of sulfur dioxide and particulate matter in the air was increased as a result of excessive use of fossil fuels. Therefore increase in mortality due to respiratory disease was observed [1]. Acute outdoor particulate matter 10 ($PM_{10}$) pollution may also associate with mortality [2]. A study between 1989 and 1991 in Chile has shown strong association between $PM_{10}$ exposure and mortality after multiple regression analysis. A change equal to10-microgram-per-cubic-meter in daily $PM_{10}$ was associated with 1% increase in mortality [3]. Heart disease, disease from stroke, respiratory disease, and lung cancer may be less if air pollution level is less. $NO_2$ pollutes the air mainly as a result of road traffic and energy production. Rising levels of nitrogen dioxide ($NO_2$) may increase the risk of death in patients with asthma [4]. Air pollution effects person's productivity [5].According to Akdur's concern in local new media, air pollution directly affect the public health and can cause mass deaths [6].A massive traffic jam in Pekin, China streching for 100km near Beijing could lasted for ten days in August 2010.Chemical reaction caused acid rain begins when compounds like sulfur dioxide ($SO_2$) and $NO_2$ are released into air.As far as scholar are concerned, $PM_{10}$ level in Istanbul is high because of exhaust gases and urban transformation. In 2014, most polluted districts in Istanbul were Esenyurt, Sirinevler, Basaksehir, and Umraniye. According to Pala, measurement of these stations in Istanbul showed that $PM_{10}$ levels were over limit in 2014 [7]. There was no limit value for particulate matter 2.5 (PM2.5) in Turkish Standards.

## 2. STUDY AREAS

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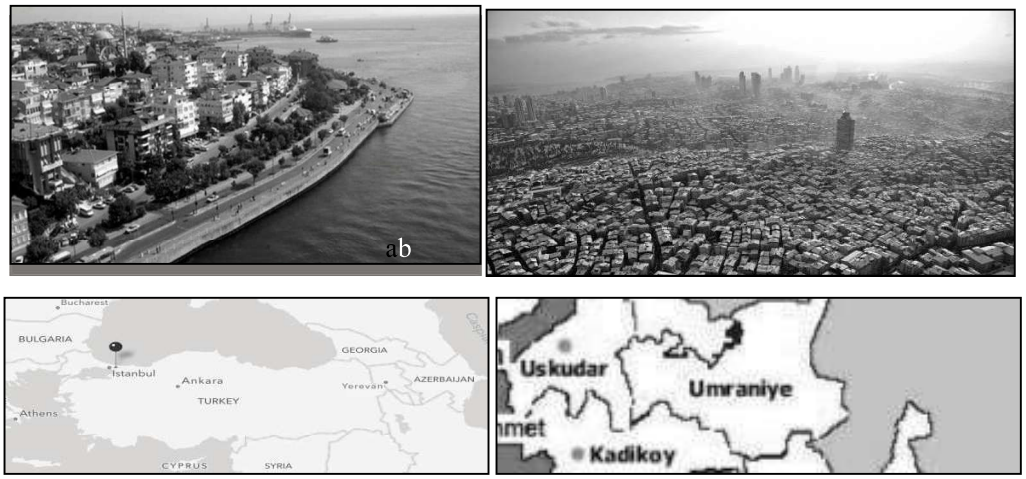



*Figure 1. Study areas: (a) Uskudar and (b) Umraniye in (d) Istanbul, (c) Turkey*

$PM_{10}$, $PM_{2.5}$, $SO_2$, $NO_2$ outdoor data in Uskudar and Umraniye over the period March 1, 2013 - December 1, 2014 is collected by Marmara Clean Air Centre in Istanbul, Turkey as shown in Figure 1.

## 3. MEASUREMENT METHODS

**$PM_{10}$ and $PM_{2.5}$ :** TS ISO 10473 : Ambient air quality- Measurement of mass particulate substance collected in a filter - Beta Ray Absorption Method

**$SO_2$ :** TS EN 14212 : Ambient air quality - Measurement method for the determination of the sulfur dioxide by ultraviolet fluorescence

**$NO_2$ :** EN 14211 : Ambient air quality – Concentration of nitrogen dioxide was determined by measuring the intensity of chemiluminescence.

## 4. RESULTS

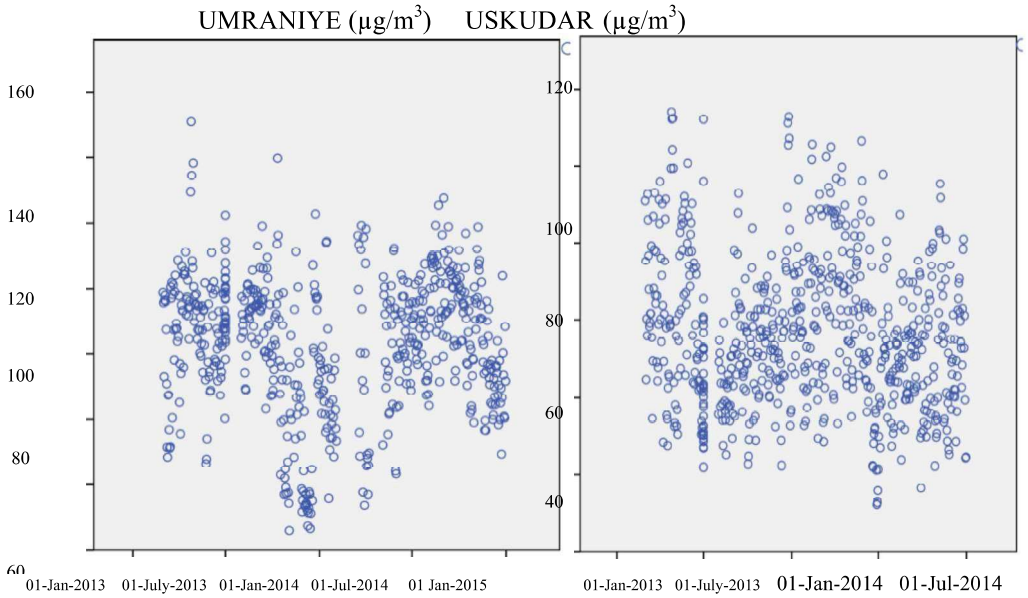



*Figure 4. Nitrogen dioxide data*

$NO_2$ data in Uskudar and Umraniye is shown in Figure 2.

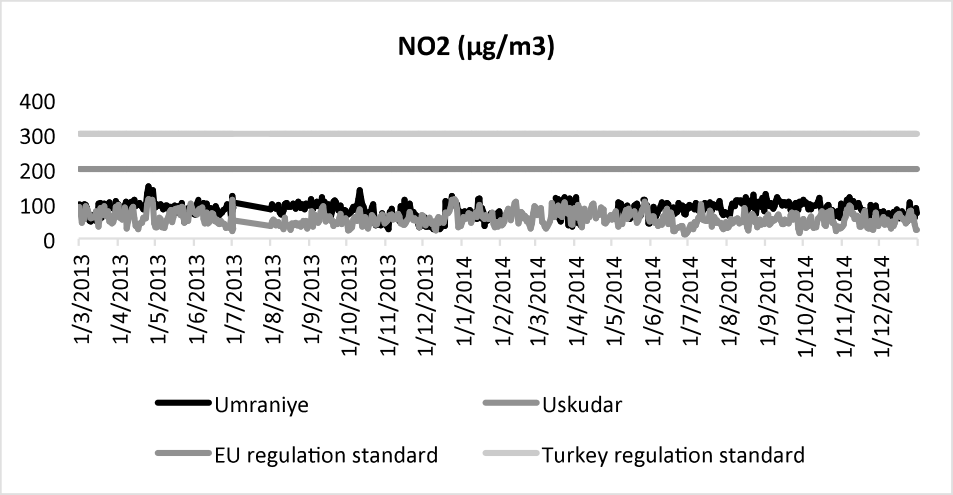



*Figure 3. Nitrogen dioxide relative to the Turkish and EU guidelines*

The highest $NO_2$ concentrations in Umraniye and Uskudar are 151µg/m$^3$ and 114µg/m$^3$. On the other hand, the lowest concentrations were 26µg/m$^3$ in Umraniye and 12µg/m$^3$ in Uskudar. When $NO_2$ concentrations in Umraniye and Uskudar compared with Turkish and EU standards, they were within allowable limits as shown in Figure 3.

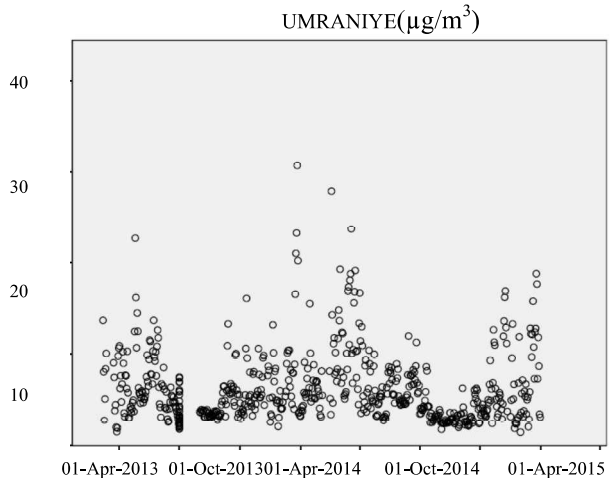



*Figure 4.Sulfur dioxide data*

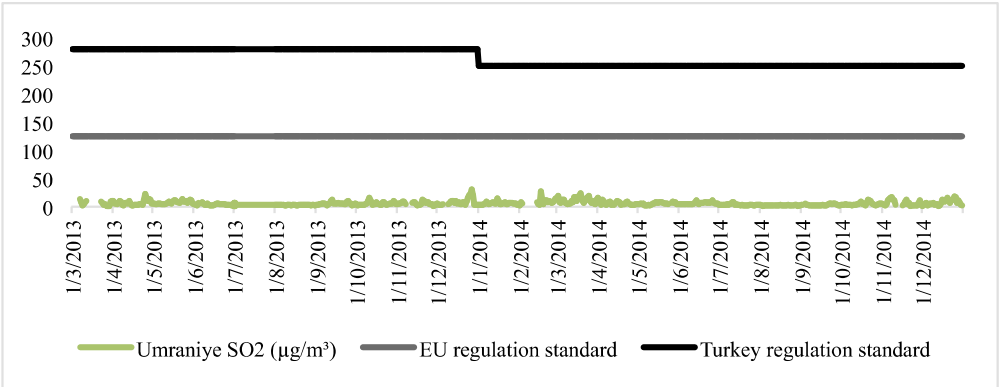



*Figure 5. Sulfur dioxide relative to the Turkish and EU guidelines*

None of the sulfur dioxide concentrations between 2013 and 2014 in Umraniye exceeded the Turkish or EU standards as shown in Figure 4,5. Actually, the highest and lowest $SO_2$ concentrations in Umraniye are respectively 31µg/m$^3$ and 1µg/m$^3$. Maximum allowed $SO_2$ concentrations approved by Turkish Law are 280µg/m$^3$ in 2013 and 250µg/m$^3$ in 2014. Besides maximum allowed $SO_2$ concentration approved by EU Law is 125µg/m$^3$.

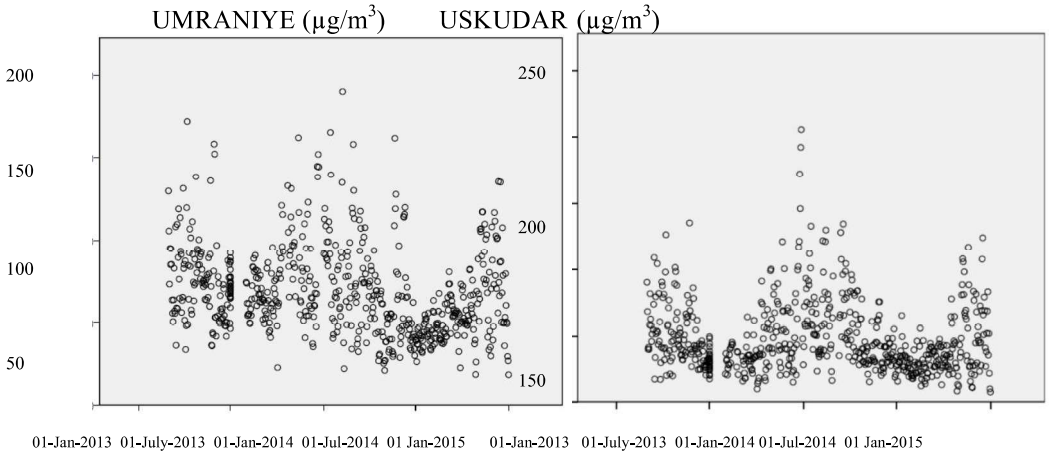



*Figure 6. Particulate matter 10 data*

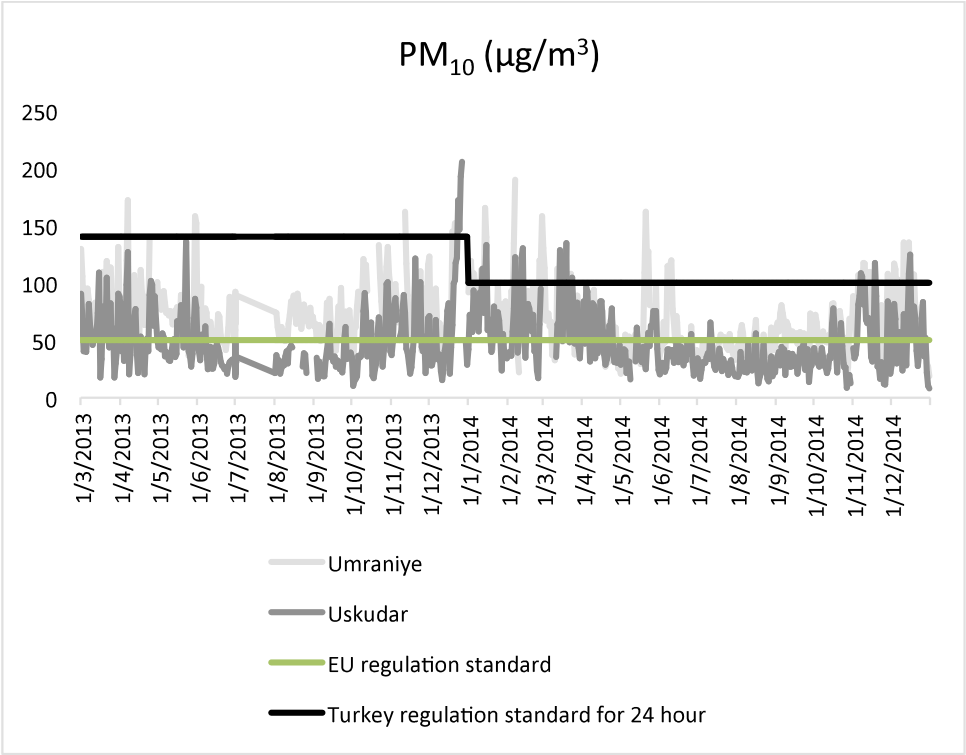



*Figure 7. Particulate matter 10 relative to the Turkish and EU guidelines*

Comparison of results showed that some of the $PM_{10}$ concentrations exceed the Turkish and EU standards as shown in Figure 6,7. Indeed, the highest $PM_{10}$ concentrations between 2013 and 2014 in Umraniye and Uskudar were respectively 189.9µg/m$^3$ and 205.6µg/m$^3$. Furthermore, the lowest $PM_{10}$ concentrations in Umraniye and Uskudar are observed respectively 18.5µg/m$^3$ and 8µg/m$^3$. Maximum allowed $PM_{10}$ values approved by Turkish Law are 140µg/m$^3$ in 2013 and 100µg/m$^3$ in 2014. In addition, maximum allowed $PM_{10}$ value approved by EU Law is 50µg/m$^3$. $PM_{10}$ pollution hovered at unhealthy levels especially in winter.

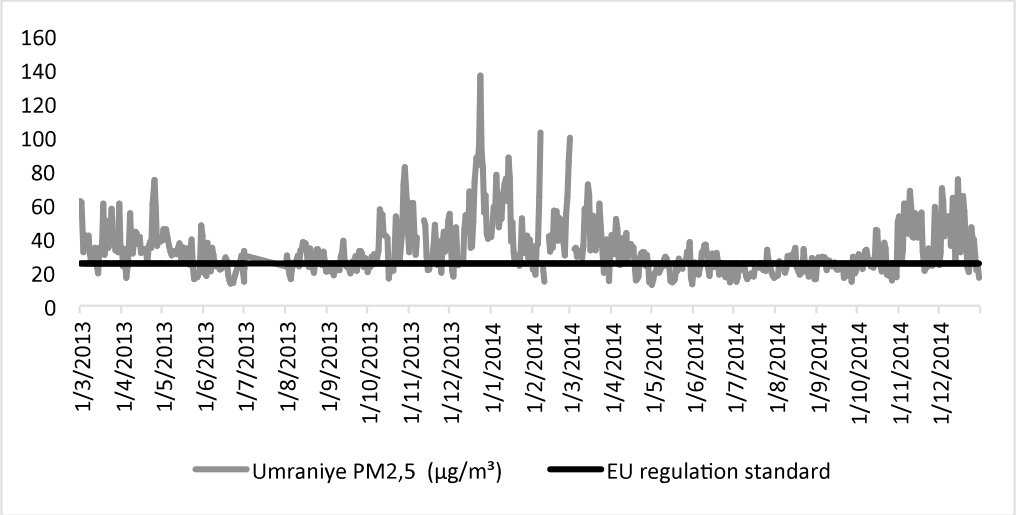



*Figure 8. Particulate matter 2.5 relative to the EU guideline*

The highest and lowest $PM_{2.5}$ concentrations in Umraniye are respectively 136µg/m$^3$ and 12µg/m$^3$ as illustrated in Figure 8. There is not limit value for $PM_{2.5}$ in Turkish Law. Besides, maximum allowed $PM_{2.5}$ value approved by EU Law is 25µg/m$^3$.

*Table 3.Death cause's rates in Istanbul and Turkey [8]*

| | | | Cause of death | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Usual residence | Year | Total | Diseases of the circulatory system | Neoplasms | Diseases of the respiratory system | Endocrine, nutritional and metabolic diseases | External causes of injury and poisoning | Diseases of the nervous system and the sense organs | Other |
| Turkey | 2013 | **360 873** | **143 084** | **76 534** | **35 364** | **20 095** | **20 409** | **14 708** | **50 679** |
| **Istanbul** | 2013 | **52 449** | 19 382 | 13 336 | 5 423 | 2 555 | 1 955 | 2 449 | 7 349 |
| Turkey | 2014 | **375 291** | **151 696** | **77 587** | **40 258** | **19 288** | **16 018** | **16 517** | **53 927** |
| **Istanbul** | 2014 | **53 854** | 19 955 | 13 432 | 6 067 | 2 681 | 1 061 | 2 836 | 7 822 |

Number of circulatory system diseases-related deaths in 2013 was 19.382 in Istanbul and 14.3084 in Turkey. In 2014 this was 19.955 in Istanbul and 151.696 in Turkey (Table 1).

Number of respiratory system diseases-related deaths in 2013 was 5.423 in Istanbul and 35.364 in Turkey. In 2014 this was 6.067 in Istanbul and 40.258 in Turkey.

Ratio of circulatory system diseases was 39.6% in 2013 and 40.4% in 2014. Ratio of respiratory system diseases was 9.8% in 2013 and 10.7% in 2014.

## 5. CONCLUSSIONS

Outdoor air quality affects the public health so emission control and monitoring are important. The Marmara Clean Air Centre in Istanbul has air quality monitoring stations. In this study, measurement values of $NO_2$, $SO_2$, $PM_{10}$ and $PM_{2.5}$ from this center were investigated. Threshold limit values (TLV) that the Ministry of Environment and Urbanisation and European legislation sets on air pollution were compared with measured values between March 1, 2013 and December 1, 2014 in Umraniye and Uskudar. Moreover EU limit concentrations of air quality parameters were compared with measured values. Concentrations of $SO_2$ in Umraniye belowed threshold limit values so health effects did not ocur. $NO_2$ findings also indicated that there was no significant threat to human health from these gasses in Umraniye and Uskudar. Nevertheless, air pollution because of $PM_{10}$ in Umraniye and Uskudar adversely must have affected health and environment especially in winter. $PM_{10}$ pollution can cause respiratory, cardiovascular diseases, asthma attacks, and lung cancer. Hence air polution endangered particularly vulnerable groups such as children, elderly and those with low immunity. To date, there is little published information about the air quality of Istanbul. Therefore, we emphasize the importance of raising public awareness that could effectively reduce air pollution by energy saving or reducing fossil fuel use. Goverment's measures like clean technology, effective public

transport are also important to prevent the inadequacy of the outdoor air quality. Press and broadcast media can be an effective way to warn people when air pollution occurs.

## ACKNOWLEDGMENT

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***Best regards,***

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| 09:15-09:30 | Opening Speeches |
| 09:30-10:30 | Speech by Invited Speaker (Mr. Lek Kadeli) |
| 10:30-10:45 | Coffee / Tea Break |
| 10:45-12:15 | Session 1 |
| 12:15-13:00 | Lunch (Only for Blue, Green and Orange Package ID Holders) |
| 13:00-14:45 | Session 2 |
| 14:45-15:00 | Coffee Break |
| 15:00-16:45 | Session 3 |
| 16:45-17:00 | Coffee / Tea Break |
| 17:00-18:30 | Session 4 |
| 19:30-20:30 | Dinner in the Hotel Restaurant (Only for Blue Package ID Holders) |
| **30.09.2016** | |
| 08:00-09:00 | Breakfast (Only for Blue and Green Package ID Holders) |
| 09:00-10:30 | Session 5 |
| 10:30-10:45 | Coffee Break |
| 10:45-12:15 | Session 6 |
| 12:15-14:00 | Lunch (Only for Blue, Green and Orange Package ID Holders) |
| 14:00-16:00 | Session 7 |
| 16:00-16:15 | Coffee Break |
| 16:15-18:00 | Session 8 |
| 19:00-21:00 | Gala Dinner (Only for Blue, Green and Orange Package ID Holders) MEETING IN THE HOTEL LOBBY |
| **01.10.2016** | |
| **Social Program (Vojvodina - Karlovci - Novi Sad Tours) (Only for Blue Package ID Holders)** | |
| 09:00-20:00 | (Vojvodina - Karlovci - Novi Sad Tours) |
| **02.10.2016** | |
| | Departures to Airport (Only for Blue, Green and Orange Package ID Holders) |

| ORAL PRESENTATIONS SEPTEMBER 29 2016 | |
|---|---|
| 10:30 | **BREAK COFFEE / TEA** |
| | **SESSION A** |
| | **A-1. Session - Chairmain: Lek Kadeli** |
| 10:45 | 058 - EUTROPHIC STATE OF THE EASTERN BASIN OF IZMIT BAY (THE MARMARA SEA) IN AUTUMN 2014 - Halim Aytekin Ergül, Merve İpsiroğlu, Serdar Aksan |
| 11:00 | 051 - A SPECTROSCOPIC STUDY: PREPARATION AND CHARACTERIZATION OF BIODEGRADABLE NON-TOXIC CELLULOSE-BASED AEROGEL - Mehmet Kaya, Ömer Sungur, Ahmet Tabak |
| 11:15 | 073 - Remediation of Selenium (IV) by Methane-oxidising Bacteria - Abdurrahman S. Eswayah, Thomas J. Smith, Andreas C. Scheinost, PHILIP H. E. GARDINER |
| 11:30 | 076 - Evaluation of PCDD/F pollution in the mussel (Mytilus galloprvincialis) tissue in Izmit Bay - Aykan Karademir, Seda Aslan Kılavuz, Bircan Telli, Halim Aytekin Ergül |
| 11:45 | 110 - Potential Ecological Risk Assessment Of Heavy Metal at Sediment - Arife Şimşek, Gülfem Bakan |
| 12:00 | 210 - Seasonal Distrubition of Fish Species in a Recent Industrial Fishing Ban Area - Serdar Aksan, Halim Aytekin Ergül |
| **12:15** | **LUNCH IN THE HOTEL RESTAURANT (Only for Blue, Green and Orange Package ID Holders)** |
| | **A-2. Session - Chairmain: Prof.Dr. Mehmet Kitiş** |
| 13:00 | 095 - Investigation of Degredability of Ibuprofen from Wastewater By Using Advanced Oxidation Process - SEVDE ÜSTÜN ODABAŞI, HANİFE BÜYÜKGÜNGÖR |
| 13:15 | 133 - INTEGRATION OF PHOTOCATALYTIC AND MEMBRANE DISTILLATION HYBRID PROCESSES FOR TEXTILE WASTEWATER TREATMENT - Nadir Dizge, H. Cengiz Yatmaz, Merve Sezen Kurt |
| 13:30 | 184 - EFFECT OF THE ANODE ELECTRODE ON PARACETAMOL REMOVAL IN THE ELECTROOXIDATION-ULTRASOUND HYBRID PROCESS - Abdurrahman AKYOL, Aybike Karaoğlu, Serdar Kara, Cevat Yaman |
| 13:45 | 129 - Carbon Nanotube Blended Mixed Matrix Membranes for Desalination - Evrim Çelik, Ozgur Cakmakcı, Ilkay Isguder, Emrah O. Tatli, Nevzat O. Yigit, Mehmet Kitis |
| 14:00 | 136 - Treatment of Metal Working Industry Wastewaters by Using Ultrafiltration - Meltem Sarioglu (Cebeci), Emine Nur Urlu |
| 14:15 | 130 - Biodegradation of PTA Wastewater by Two-Stage Anaerobic Reactor Systems - Tayyibe Alpay, Burcin Karabey, Nuri Azbar, Güven Özdemir |
| 14:30 | 167 - Electrooxidation of Pretreated Transport Container Washing Wastewater - Serdar Kara, Tulin Yılmaz Nayır, Abdurrahman Akyol, Cevat Yaman |
| 14:45 | **BREAK COFFEE / TEA** |
| | **A-3. Session - Chairmain: Assoc.Prof.Dr. Abdurrahman Akyol** |
| 15:00 | 086 - Production of bio-pellets derived from sawdust and crude glycerol - Veli Gokhan Demir, Pasa Yaman, Mete Oguzhan Efe, Hayrettin Yuksel |
| 15:15 | 103 - Deep Sea Outfall of Natural Gas Fired Combined Cycle Power Plant Cooling Water Application and Modeling - Tolga Ayeri, Yüksel Ardalı |
| 15:30 | 124 - A New Study Promising PET Removal: Microbial Monomer Degradation - Caner Vural, Tuğba Topbaş, Cansu Doğan, Güven Özdemir |
| 15:45 | 156 - CATALYTIC GASIFICATION OF GALACTURONIC ACID AS A MODEL COMPOUND FOR HEMICELLULOSES - Dilek Selvi Gökkaya, Mehmet Sağlam, Mithat Yüksel, Levent Ballice |
| 16:00 | 166 - Pyrolysis of impregnated decor papers - Gülşen Yaman, Halil Sinoplugil |
| 16:15 | 104 - Investigation of Domestic Wastewater Discharge Performance of Submarine Outfalls in Rize Province and Alternative Proposals - Özge Köksal, Tolga Ayeri |
| 16:30 | 003 - Biodiesel Production Using Wet and Dry Purification Methods - Veli Gokhan Demir, Baybars Ali Fil, Vedat Demirtaş, H. Serhad Soyhan |
| **17:00** | **BREAK COFFEE / TEA** |
| | **A-4. Session - Chairmain: Assoc.Prof.Dr. Cevat Yaman** |
| 17:00 | 112 - Energy literacy in Southeast Europe - Josip NAGLIC, Ana STAJMINGER |
| 17:15 | 022 - BIOFUEL PRODUCTIN FROM CO2 IN POLLUTED AREAS BY ISOLATION OF Synechococcus elongatus FROM A LAKE IN TURKEY - Cansu Doğan, Delia Teresa SPONZA |
| 17:30 | 006 - Utilization of Olive Cake in Biofuel Industry as Pellet and Briquette Fuels - Veli Gokhan Demir, Pasa Yaman, Hayrettin Yuksel |
| 17:45 | 182 - Biogas Efficiency, Leachate Quality and Waste Stabilization in Anaerobic Landfill Bioreactors - Cevat Yaman, Yusuf Küçükağa, Abdurrahman Akyol, Serdar Kara |
| 18:00 | 179 - IRRIGATION Purposed dams as a source of MINI hydropower in AFYONKARAHISAR - Murat Kilit |
| 18:15 | End of the day |
| **19:30** | **DINNER IN THE HOTEL RESTAURANT (Only for Blue Package ID Holders)** |

| ORAL PRESENTATIONS SEPTEMBER 30 2016 | |
|---|---|
| | **SESSION A** |
| | **A-5. Session - Chairmain: Asst.Prof.Dr. Nadir Dizge** |
| 09:00 | 180 - Investigation on the characteristics and management of dental wastewater in Tehran, Iran - Majid Bahramian, Özer Çınar, Naser Mehrdadi |
| 09:15 | 008 - Carbon storage and nutrient stocks distributions of three adjacent land use patterns in Lake Danao National Park, Ormoc, Leyte, Philippines - P. Aphrodite Bobon-Carnice, SUZETTE B. LINA |
| 09:30 | 028 - Ecotoxicological Investigation of Three Nano-metal Oxides (HfO2 ,SiO2, ZnO) on Four Trophic Levels (Bacteria, Yeast, Mold and Algae ) and their .... - Nefise ERDİNÇMER, Delia Teresa Sponza |
| 09:45 | 108 - Benchmarking Effects of Organic and Conventional Farming Applications at Hazelnut Orchards in Dryland - Selçuk Özmen |
| 10:00 | 170 - Isotherm and Kinetic Modelling of Azo Dyes Adsorption - Onur Işık, İbrahim Demir, Ahmet Yüceer, M. Akif Veral, Özer Çınar |
| 10:15 | 196 - Flood Risk Analysis of Akarcay River on the Uydukent Settlement Place - Murat Kilit |
| 10:30 | **BREAK COFFEE / TEA** |
| | **A-6. Session - Chairmain: Prof.Dr. Meltem Sarıoğlu (Cebeci)** |
| 10:45 | 154 - Determination of Appropriate Technology from Paper Industry Wastewater for Reuse - Esra Can Doğan, Ali Oğuzhan Narcı, H. Cengiz YATMAZ, Elif DURNA, Mine Selin AKNAR, Sevgi TOPÇU,Tuğba Nur YILMAZ, Coşkun AYDINER |
| 11:00 | 178 - Comparison of Performance of Conventional Membrane Bioreactor with Dynamic Membrane Bioreactor - M. Akif Veral, Abdullah Kızılet, Özer Çınar |
| 11:15 | 189 - Photocatalytic degradation of reactive red 180 dye solution enhanced by hydrodynamic cavitation - Yasemin Calıskan, H. Cengiz Yatmaz, Nihal Bektaş |
| 11:30 | 120 - Investigation of Optimum Treatability of Paper Industry Wastewater with Innovative Application by Using Fenton and and Photo-Fenton Enhanced Ultrafiltration - Esra Can DOGAN, Ali Oğuzhan NARCI, Berna Kırıl MERT, Odul KILICOGLU, Umur Alkan AKBACAK, Coşkun AYDINER |
| 11:45 | 027 - CONTAMINATION OF CLAY LAYERS WITH DNAPL WASTES AND IMPACT OF CRACKS ON CONTAMINANT ACCUMULATION - Derya AYRAL CINAR, Avery H. DEMOND |
| 12:00 | 181 - Pulp and paper wastewater treatment by using chemical and biological processes: chemical coagulation followed by .... - Abdullah Kızılet, Merve Yurdakul, Dilda Gümüşçü, Amar Cemanovic, Özer Çınar |
| 12:15 | **LUNCH IN THE HOTEL RESTAURANT (Only for Blue, Green and Orange Package ID Holders)** |
| | **A-7. Session - Chairmain: Assoc.Prof.Dr. Didem Gökçe** |
| 14:00 | 017 - Hay Yield Performance of Soybean Genotypes From Diverse Origins - Esvet Acikgoz, Abdurrahim Tanju Goksoy, Aysen Uzun, Mehmet Sıncık |
| 14:15 | 055 - Protective Role of Humic Acid in Lettuce (Lactuca sativa L.) Subjected to UV-B Radiation - Özkan AKSAKAL, Feyza ICOGLU AKSAKAL, Aslıhan Esringu |
| 14:30 | 056 - Ecological and socio-economic effects of invasive species Rapana venosa in the Black Sea Ecosystem - Hacer SAGLAM, ERTUG DUZGUNES |
| 14:45 | 098 - Endemic Taxa of The Genus Muscari Mill. in Turkey, Threatened Categories and Conservation Status Assessments - Hüseyin EROĞLU, Süleyman Mesut PINAR |
| 15:15 | 102 - Relationships between Nanoparticle TiO2 and Daphnia magna Population Dynamics - Didem Gökçe |
| 15:30 | 148 - Biodegradation Of Terephthalic Acid By Some Microorganisms Isolated From Activated Sludge - Didem Eroğlu, Burçin Karabey, Caner Vural, Güven Özdemir |
| 15:45 | 125 - Biohydrogen production from molasses: Effect of photooxidation to molasses - Nevim Genç, İsmail Özbay, Elif Durna |
| 16:00 | **BREAK COFFEE / TEA** |
| | **A-8. Session - Chairmain: Asst.Prof.Dr. Aziz Satana** |
| 16:15 | 127 - EFFECTS OF USING ECO-FRIENDLY LUBRICANTS IN PUMP BEARINGS INSTEAD OF TRADITIONAL LUBRICANTS - Fatih Dökme, Muzaffer Turan |
| 16:45 | 193 - Outdoor Air Pollution Increased with Urban Transformation in Istanbul Anatolian Side - Esin Bozkurt, Güssün Günes |
| 17:00 | 195 - Medical Waste Management in Turkey - İbrahim Demir, Osman Atilla Arıkan, İzzet Öztürk, K. Elif Macin |
| 17:15 | 042 - Evaluation of the Structural and Plant Landscape Designs of The European Town Squares - Nurhan Koçan |
| 17:30 | 204 - Heavy Metals Analysis in Irrigation Water and Sugar Beet (Beta vulgaris L.) in Ergene Basin, Turkey - Aziz Satana |
| 17:45 | 199 - A Calculation Method for Determination of Household Solid Waste Tariffs - İbrahim Demir, Yavuz Soysal, Esra Tınmaz Köse, Osman Atilla Arıkan |
| 18:00 | End of the day |
| **19:00** | **GALA DINNER - MEETING IN THE HOTEL LOBBY (Only for Blue Package ID Holders)** |