



American International University-Bangladesh (AIUB)

SDG Activity Report on

SDG 6: Clean Water and Sanitation



**Ensure availability
and sustainable
management of water
and sanitation for all**

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SDG 6: Clean Water and Sanitation

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Faculty Research and Publication

Preparation of Activated Carbon/TiO₂ Nanohybrids for Photodegradation of Reactive Red-35 Dye Using Sunlight

Author: Dr. Mohammad Tariqul Islam et al.

Brief Description:

Activated carbon/titanium dioxide (AC/TiO₂) nanohybrids were synthesized by a hydrothermal technique using various weight percent of commercial AC and were characterized by X-ray diffraction (XRD), field emission scanning electron microscopy (FESEM), Fourier transform infrared (FTIR) and thermogravimetric analysis (TGA). The synthesized nanohybrids were applied to photodegradation of Reactive Red-35 (RR-35) dye in aqueous solution using sunlight. Due to the synergistic effect of adsorption and photodegradation activity, AC/TiO₂ nanohybrids were more efficient in treating the aqueous dye solution than that of AC and TiO₂. The maximum (95%) RR-35 dye removal from the water was obtained with 20 wt% AC/TiO₂ within 30 min at natural pH of 5.6. The possible photodegradation mechanism of RR-35 dye with AC/TiO₂ was discussed from the scavenger test. Moreover, AC/TiO₂ was found to be suitable for long-term repeated applications through recyclability experiments. Therefore, AC/TiO₂ nanohybrid is a promising photocatalyst for treating azo dyes especially RR-35 from water.

Source: <https://www.mdpi.com/journal/photochem>

Sea Water Desalination for Coastal Area Using Concentrated Sunlight and Solar Panel

Author: Nadia Nowshin et al.

Brief Description:

All over the world, it is quite difficult to do the desalination of sea water. Alongside it is very tough to do cultivation and manage daily needs in a coastal area due to lack of distilled water. And the traditional desalination processes are very costly and time consuming at the same time. So, in this project a solar-desalination process is proposed that desalinate sea water with a very low cost and effort. Besides that human civilization is now pushed forward to a new era where every bulk automated structure is getting compact through the use of microcontroller. This incited us to design a microcontroller based solar-desalination system, which is powered by solar energy. The proposed model of sea water desalination for coastal area uses concentrated sunlight through Fresnel Lens as the main factor together with a solar panel. And the whole process of sea water collection to desalination of the water is controlled via an Arduino Uno.

Source: https://link.springer.com/chapter/10.1007%2F978-3-030-29516-5_89

Transboundary Water Agreements of South Asia: Does the Principle of Equitable and Reasonable Utilization of Water Exist?

Author: Ferdousi Begum et al.

Brief Description:

There are different theories and principles of international water law related to transboundary water resources management. One of the most fundamental principles of transboundary water resources management is the idea of equitable and reasonable utilization of water. This principle reflects the view of regulating the use of international shared water resources. It is introduced by the Helsinki Rules, reinvented by the Draft Articles and finally it recognized as a treaty law when the Convention on the Law of the Non-navigational Uses of International Watercourses, 1997 had incorporated this principle in Article 5. In applying this principle the standard is not what is an equitable use for the activities of a State from a shared watercourse rather what is equitable in relation to other States using the same. The scope of using the principle of equitable and reasonable utilization of water depends upon the facts and circumstances of each individual case and also upon other surrounding factors. There are so many transboundary water agreements in South Asian region. This article will examine whether the transboundary water agreements of South Asian region take into account the principle of equitable and reasonable utilization of water while using water from shared water resources. It will also examine how this principle is evolving in international law and so far how it is working in this region.

Source: <https://www.biliabd.org/article%20law/Vol-18/Ferdousi%20Begum.pdf>

IoT (Internet of Things) - Based Smart Garbage Management System: A Proposal for major Cities of Bangladesh

Author: MOHAIMEN-BIN-NOOR et al.

Brief Description:

IoT—internet of things has become a buzzword nowadays. There are many IoT based researches but researches on garbage management system based on IoT are not sufficient. Insufficient and inefficient garbage management system causes severe environmental problem. It also makes the air toxic. This problem has become a common problem in the world especially in Bangladesh. Dhaka city, the capital of Bangladesh lacks well organized and efficient garbage management system. Maximum roads of Dhaka city are surrounded by garbage. The bad smell of garbage affects people's mental health, inhaling toxic causes many diseases. Lack of dustbins, throwing of garbage here and there, misuse of dustbins are making city life very unhealthy and also causes a threat to environment. The dustbins are being stolen or damaged which is also a great problem. In this paper, we proposed about an efficient garbage management system based on IoT. This research works aims to provide a minimal solution to this problem using the IoT technology. We propose for a smart garbage system, which consists of sensors, RFID, IR sensors, admin and user

website, Wi-Fi module etc. These smart bins will monitor the level of garbage when it will reach 75% of its capacity, it will give notification to the admin website, so the authority concerned can collect the garbage from the bins timely and there will be no overflow of garbage as the authority will get notified earlier. There will be a feature in user website that will let the user know about the nearest smart garbage bins current condition, so if there is any condition that the garbage bin of their place is full they can use the nearest bin. This research work also aims to have secured smart garbage bins, as there is chance the bins to be stolen and damaged so in this research we talk about security of the sensors and the bins will have cement body. So this research is for implementing an efficient garbage management system which will reduce expense on this sector, misuse of bins. Making a clean country, pollution free environment with an efficient and well organized garbage management system can bring a new era. It is expected that the proposed garbage management system will reduce financial cost in this sector as well as reduce problems related to waste management.

Source: <https://ajse.aiub.edu/index.php/ajse/article/view/55/6>

Micro-fabricated thermal flow-rate sensors: the substrate material impact on the device performance and power consumption

Author: Dr. Ferdous Jahan Shaun et al.

Brief Description:

Abstract- We report on micro-machined flow-rate sensors as part of autonomous multi-parameter sensing devices for water network monitoring. Three different prototypes of the flow-rate sensors have been designed, fabricated and experimentally characterized. Those sensors are made of identical micrometric platinum resistors deposited on different substrates, made of glass, silicon and micro-structured silicon, with and without insulation layers. The sensors are tested under the anemometric operating scheme. They are experimentally characterized under a water velocity range from 0 to 0.91 m/s. We show that the glass substrate device is more sensitive and less power-consuming under identical operating condition. We also show that, when silicon is needed as the substrate material, further optimization and design strategies are required. Experimental results are analyzed with respect to computational fluid dynamics simulations with the finite element method.

Source: <https://link.springer.com/article/10.1007/s00542-018-4098-5>

Sensitivity optimization of micro-machined thermo-resistive flow-rate sensors on silicon substrates

Author: Dr. Ferdous Jahan Shaun et al.

Brief Description:

We report on an optimized micro-machined thermal flow-rate sensor as part of an autonomous multi-parameter sensing device for water network monitoring. The sensor has been optimized under the following constraints: low power consumption and high sensitivity, while employing a large thermal conductivity substrate, namely silicon. The resulting device consists of a platinum resistive heater deposited on a thin silicon pillar $\sim 100\text{ }\mu\text{m}$ high and $5\text{ }\mu\text{m}$ wide in the middle of a nearly $100\text{ }\mu\text{m}$ wide cavity. Operated under the anemometric scheme, the reported sensor shows a larger sensitivity in the velocity range up to 1 m s^{-1} compared to different sensors based on similar high conductivity substrates such as bulk silicon or silicon membrane with a power consumption of 44 mW . Obtained performances are assessed with both CFD simulation and experimental characterization.

Source: <https://iopscience.iop.org/article/10.1088/1361-6439/aab6bd/meta>

Energy efficient micro-machined thermal flow-rate sensor based on transient operation mode

Author: Dr. Ferdous Jahan Shaun et al.

Brief Description:

We report on a micro-machined thermos-resistive flowrate sensor optimization with respect to energy consumption while using a large thermal conductivity substrate, silicon for instance. Two aspects of the device are optimized for this purpose: its geometry and its operating scheme. Large thermal conductivity materials are not recommended for thermal flowrate sensors since they induce large thermal leakage. However, they can be needed for some lab-on-chip devices where the co-integration of several sensors and components is the main constraint. Under these conditions, we show that the flow-rate sensor thermal efficiency can be increased by geometric optimization and its energy consumption significantly reduced by operating the device in transient mode. The original reference device is fabricated on bulk silicon where the heating element is made of platinum (Pt). Then, a geometric optimization is performed to increase the heating resistor thermal insulation by creating a micro-pillar in the middle of a cavity to support the heater. The pillar structure flow-rate sensor exhibits $2.5\text{ }^{\circ}\text{C}$ temperature under no-flow while the bulk silicon-based sensor shows $0.8\text{ }^{\circ}\text{C}$ only under 30 mA current supply. This larger temperature increase under no flow leads to a larger sensitivity of the former. In addition, transient operating mode enables the minimization of the pre-measurement waiting time, hence a reduction of the device energy consumption. While a steady-state measurement requires a

heating time of the order of 20 minutes, a transient mode measurement can be performed after a heating time lower than 3 minutes.

Source: <https://ieeexplore.ieee.org/document/8394233>

Thin-Film Thermoresistive Platinum Sensor for Water Temperature Measurement

Author: Dr. Ferdous Jahan Shaun et al.

Brief Description:

We report on a micro-machined thin-film temperature sensor for measuring water temperature mainly in the water distribution network. The sensor is made of platinum (Pt) thin-film; which dimensions are $12255 \times 11 \times 0.34$ micrometer. The investigation is performed for two versions of the considered sensor, where the substrate material is changed from glass to silicon. The sensors are tested at a constant 0.5 mA current supply. The supply current intensity is intentionally kept low, in order to avoid Joule Self-heating; which is mandatory for ambient temperature measurement. Both sensors show similar Joule self-heating at low current supply. The target is to co-integrate this temperature sensor along with some other sensors on the same chip, in order to deliver a monolithic multi-parametric sensing module. Hence, silicon substrate-based temperature sensor is finalized; as this material facilitate the fabrication and cointegration step among multiple sensors. The ascertained sensor shows excellent linearity in the first phase characterization in a laboratory environment within the temperature range from 25 °C to 90 °C. The confidence interval (95%) of the measured data is better than 0.2 °C.

Source: <https://ieeexplore.ieee.org/document/9071946>

Understanding the Impact of Social Determinants of Health in Street Food Safety: A Qualitative Study in Bangladesh

Author: Dr. Iffat Tasnim Haque et al.

Brief Description:

Street food is one of the informal sectors, especially in developing countries where it fulfils the daily food requirements for many low- and middle-income people. However, the lack of awareness about food safety and unsafe food consumption increase the burden of diseases which impacts on the health and economic condition of both vendors and customers. The ad hoc-based intervention programmes on some particular groups or area cannot be able to promote the knowledge in mass level. Moreover, we need to focus on understanding the other social determinants of health impacting on the behaviour of unsafe street food practices. A qualitative study on understanding the social determinants of health-related with street food safety and health promotion activities was conducted in Khulna city, a third major city in Bangladesh. Both

vendors and customers were participated in the study through interviews and focus group discussions. Based on the qualitative thematic analysis of data, four wider social determinants of health were found in major which have a strong impact on street food safety behavioural practices among vendors and consumers. Moreover, these determinants also play as barriers to achieve food safety knowledge and practice. Lack of focus on these determinants by macro-level stakeholders, lack of convenient educational materials or promotional activities increase the severity of the situation. Based on the outcome and participant recommendation, a model has been developed to tackle the situation where collaborative approach is required among all related stakeholders.

Source:

<https://www.tandfonline.com/doi/full/10.1080/14635240.2020.1719860?scroll=top&needAccess=true>