

**Faculty of Applied Sciences**  
**Sabaragamuwa University of Sri Lanka**

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# **PEER-REVIEWED JOURNAL ARTICLES**

## **The distribution, fate, and environmental impacts of food additive nanomaterials in soil and aquatic ecosystems**

Shiv Bolan, Shailja Sharma, Santanu Mukherjee, Pingfan Zhou, Jajati Mandal, Prashant Srivastava, Deyi Hou, Randima Edussuriya, Meththika Vithanage, Vi Khanh Truong, James Chapman, Qing Xu, Tao Zhang, Pramod Bandara, Hasintha Wijesekara, Jörg Rinklebe, Hailong Wang, Kadambot H.M. Siddique, M.B. Kirkham, Nanthi Bolan

### **ABSTRACT**

Nanomaterials in the food industry are used as food additives, and the main function of these food additives is to improve food qualities including texture, flavor, color, consistency, preservation, and nutrient bioavailability. This review aims to provide an overview of the distribution, fate, and environmental and health impacts of food additive nanomaterials in soil and aquatic ecosystems. Some of the major nanomaterials in food additives include titanium dioxide, silver, gold, silicon dioxide, iron oxide, and zinc oxide. Ingestion of food products containing food additive nanomaterials via dietary intake is considered to be one of the major pathways of human exposure to nanomaterials. Food additive nanomaterials reach the terrestrial and aquatic environments directly through the disposal of food wastes in landfills and the application of food waste-derived soil amendments. A significant amount of ingested food additive nanomaterials (> 90 %) is excreted, and these nanomaterials are not efficiently removed in the wastewater system, thereby reaching the environment indirectly through the disposal of recycled water and sewage sludge in agricultural land. Food additive nanomaterials undergo various transformation and reaction processes, such as adsorption, aggregation-sedimentation, desorption, degradation, dissolution, and bio-mediated reactions in the environment. These processes significantly impact the transport and bioavailability of nanomaterials as well as their behaviour and fate in the environment. These nanomaterials are toxic to soil and aquatic organisms, and reach the food chain through plant uptake and animal transfer. The environmental and health risks of food additive nanomaterials can be overcome by eliminating their emission through recycled water and sewage sludge.

### **About the Journal**

Science of The Total Environment

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## **Soil Erosion Assessment with InVEST Model: Case Study in Wee-Oya Watershed in Sri Lanka**

M.W.D. Sandamali, E.P.N. Udayakumara, C.H Baduraliya, T.L. Dammalage and Mohamed Shafras

### **ABSTRACT**

Human-induced soil erosion is one of the most significant types of land degradation in the Wee Oya watershed in Sri Lanka. The high intensity of rainfall, steep slopes, and inappropriate land use practices are strongly associated with soil erosion in the area. The prime aim of the study was to estimate soil erosion in the watershed and its seven sub-watersheds using the Integrated Valuation of Ecosystem Services and Tradeoffs (InVEST), Sediment Delivery Ratio (SDR) model. Furthermore, a comprehensive household (HH) questionnaire survey (n=30) was conducted to ascertain key socio-economic information such as the farmer's age, gender, education level, the extent of land for cultivation, and the degree of practicing soil and water conservation (SWC) measures. Then, the multiple regression analysis was applied to determine the significant socio-economic determinants of erosion in the watershed. The results of the assessment disclosed that the present average annual rate of human-induced soil erosion of the watershed is 167 t/ha/yr. Moreover, the most significant ( $p < 0.05$ ) socio-economic determinants of the soil erosion of the study area are the farmer's age and family size. Furthermore, the study revealed that more than 50% of the farmers do not have a substantial perception of existing government policies' implications concerning human-induced soil erosion. Finally, the outcome of the assessment has highlighted the necessity of human intervention for effective SWC measures in the study area.

### **About the Journal**

Asian Journal of Microbiology, Biotechnology &  
Environmental Sciences

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## Preparation of electrospun polyacrylonitrile (PAN) nanofiber membrane gel electrolyte and its application in TiO<sub>2</sub>-based electrochromic devices

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### ABSTRACT

Electrochromic devices based on nanofiber membrane gel electrolytes offer several advantages over polymer gel electrolytes. Many advantages, such as high chemical stability, easy handling, less leakage, a wide working temperature range, and a long cycle life, show high compatibility of nanofiber membrane electrolytes in different electrochemical power devices. In this work, we have succeeded in replacing the liquid electrolyte with a nanofiber membrane-based gel electrolyte prepared by the electrospinning method and applied in electrochromic devices (ECD). Polyacrylonitrile (PAN)-based nanofibers were deposited on a spin-coated SnO<sub>2</sub> layer, prepared on a fluorine-doped tin oxide (FTO) glass substrate. The thickness of the fiber mat was varied by changing the time of the electrospinning. Gel-type membrane electrolyte was prepared by soaking the nanofiber membrane electrode in the 1 M LiClO<sub>4</sub> in propylene carbonate (PC) solution. TiO<sub>2</sub> electrochromic electrode was prepared by the “doctor blade” method. ECDs were fabricated with the configuration of FTO glass/TiO<sub>2</sub>/PAN-based nanofiber membrane gel polymer electrolyte/SnO<sub>2</sub>/FTO glass by sandwiching the two electrodes. Electrochromic performance of ECDs fabricated with nanofiber membrane gel electrolyte was compared with ECDs fabricated with liquid electrolyte (1 M LiClO<sub>4</sub> in PC) and PAN-based conventional gel electrolyte (PC (0.4 g) + ethylene carbonate (EC) (0.4 g) + LiClO<sub>4</sub> (0.03 g) + PAN). ECDs with nanofiber membrane gel electrolytes demonstrate a transmittance variation of 33.40% in the visible region which is 93% of the corresponding value obtained with liquid electrolyte-based ECD, whereas identical ECDs made with conventional gel electrolytes demonstrate a lower transmittance variation of 4.22%.

### About the Journal

Ionics

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## **Narrative review on the importance of yoga in physical education and sports**

Selliah Joniton , Mohamed Shafras , Dilani Chathumali Jayasekara

### **ABSTRACT**

One of India's spiritual systems, yoga, emphasizes the value of working with the human body to develop good thoughts and behaviours. Additionally, yoga assists in balancing our physical and mental conditions. However, lack of understanding about the impact of yoga in sports seems to have led to a decline in yoga practise specifically among sportsmen and sportswomen. Thus, this narrative review is designed for sportsmen and sportswomen, physical education students, teachers, yoga students, health professionals, and those who are inclined to study yoga. This review identifies a leaner relationship between the systems of yoga and sports, and provides information on the value of yoga in physical education and sports. All the data in this article were collected using search terms including “yoga”, “physical education”, “asana” and “sports”. Various beneficial yoga factors influence sport performance, and these important factors are outlined with appropriate evidence. All the findings included in this review paper highlight the importance of yoga in physical education and sports, and warrant the need of special awareness of the system of yoga in health, physical and sports education.

### **About the Journal**

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Education

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# **CONFERENCE PROCEEDINGS**

## Value addition to the black tea using leaves of common guava, Ceylon Cinnamon and evaluation of its functional properties

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### ABSTRACT

Innovative tea formulation was developed by introducing an herbal infusion of medicinal plants which enhance the functional properties of the black tea. The leaves of common guava (*Psidium guajava*) and the both leaves and bark of Ceylon Cinnamon were collected from Matara, Sri Lanka (latitude-5.94780N, longitude-80.54830E). Shade-dried plant material is blended to reach the highest sensory quality of the final product (guava leaves: Cinnamon bark: Cinnamon leaves: black tea in 11:3:3:3 ratios). The tea was tested for antioxidant activity using the ferric reducing antioxidant power assay (FRAP), 2,2'-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging assays, total phenolic content (TPC) using the Folin-Ciocalteu assay, total flavonoid content (TFC) using aluminium chloride colorimetric assay, and anti-diabetic activity using the alpha-glucosidase inhibitory assay. The antibacterial properties were assessed using the agar disk diffusion assay and preliminary cytotoxic effects were examined through the brine shrimp assay. The formulation exhibited significantly high total anti-oxidant activity in FRAP ( $49.95 \pm 0.40$  mg Trolox/g) and an  $IC_{50}$  of  $40.01 \pm 0.01$  mg/ml for DPPH assay ( $31.59 \pm 2.92$  mg/ml for the ascorbic acid standard). It also demonstrated high alpha glucosidase inhibition activity with an  $IC_{50}$  of  $1.43 \pm 0.08$  mg/ml compared to the acarbose standard ( $IC_{50}$   $3.28 \pm 0.28$  mg/ml). The extract contained TFC and TPC at  $3.49 \pm 0.40$  mg of quercetin/g and  $162.40 \pm 6.12$  mg GAE/g, respectively. The extract is safe based on brine shrimp lethality assay. The highest antibacterial activity was shown against *Staphylococcus aureus* from tested bacteria species (inhibitory zone of  $7.00 \pm 0.57$  mm). In conclusion, the prepared guava tea enhanced with cinnamon formulation is a novel natural functional product that can be used as an alternative to black tea for obtaining health benefits.

### About the Conference

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24 January 2024  
University of Ruhuna, Matara, Sri Lanka

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## **The impact of structured exercise programs on the gross motor skills development of children with Attention Deficit Hyperactivity Disorder (ADHD)**

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### **ABSTRACT**

Attention Deficit Hyperactivity Disorder (ADHD) is a neurodevelopmental condition characterized by symptoms like inattention, impulsivity, hyperactivity, and behavioral control challenges, often associated with sensory, motor, or emotional neurological factors. The aim of this study was to explore the impact of structured exercise programme on development of gross motor skills in children diagnosed with ADHD. This study involved 28 participants (16 boys and 12 girls), aged between 5 and 10 years, who were selected purposefully due to their ADHD diagnosis. Baseline assessments were conducted using the Test of Gross Motor Development-2 (TGMD-2). Over a seven-week period, a structured gross motor skills training program was administered, comprising two sessions per week, each spanning 40 minutes in Chithra Lane School. The data analysis utilized a paired T-test in Minitab, revealing noteworthy improvements in gross motor skills, with a remarkable p-value of 0.000 observed in the TGMD-2 gross motor quotient. In conclusion, the findings from this study underscore the effectiveness of the proposed gross motor skills training program in significantly enhancing the gross motor skills of children diagnosed with ADHD. These results emphasize the importance of addressing motor skill development as a component of ADHD management in improving the daily functioning and overall quality of life of children grappling with ADHD.

### **About the Conference**

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