SCO-Young Scientist Profile

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Details of research work carried out in S&T:

By training, I am a material engineer and am working towards developing materials/techniques/methods and devices for energy and environment application in particular (a) water quality/pollutants monitoring (b) pollutants (water/air) degradation, and (c) hydrogen generation via water splitting. I have established novel facile synthetic routes for a wide range of materials like carbon quantum dots, metal nanoparticles, 2D-materials, graphene-metal/metal oxide hybrid materials, and further demonstrated their device applications for upfront research areas of sensing (Water Pollutants) and energy harvesting (H2 Fuel). With expertise developed in techniques: SERS, Colorimetry, Fluorescence, Electrochemistry, I have developed "Sensors and Systems" for monitoring of water pollutants/parameters using functional materials and engineered heterostructures/composites materials. The developed materials (carbon nanostructures, organic linkers, metallic nanostructures, etc.), have been translated into affordable reagent kits and paper strips for heavy metals (like selenium, arsenic, lead, and iron) testing in water. A portable device is also developed for heavy metals quantification and residual chlorine detection in water, integrated with smart-phone and Mobile Apps, namely "HMIsense and "Chlorosense". I have also played a key role in materials engineering, followed by the design, development, and technology transfer of a "Portable Integrated Optical System" for nitrate, fluoride, and arsenic detection in water to M/s Ambtek innovations, Haryana. Additionally, I have designed environment-friendly materials for several other inorganic/organic pollutants detection and degradation including iron, chromium, organic pollutants, pharmaceutical pollutants, etc., which are also reported in high impact publications.

Associated SCO-YSC Theme: Environment Protection and Natural Resource Management

Shanghai Cooperation Organization- 1st Young Scientists Conclave (SCO-YSC 2020)
A virtual event organsied in India at CSIR-IICT, Hyderabad
Theme: **Shaping SCO-STI Partnership: Young Scientists Perspectives**

Statement of Innovation:

My research and development are envisioned in contributing towards UN SDG goals, in particular (a) SDG 6: Clean Water and Sanitation and (b) SDG 7: Affordable and Clean Energy. Ensuring safe and enough water quality in SCO countries is of prime concern. In this direction, I am working towards the translation of fundamental material science into the societally relevant engineered product through interdisciplinary research. In the area of water quality monitoring, I am working towards developing novel sensor materials based upon translational techniques such as Raman Scattering, Colorimetry, Fluorescence, Absorbency, Electrochemistry, etc., as they can be made into field usable products/kits. With the rise of IoT, these technologies, I propose to integrate these sensor systems with software/IoT tools to bring more user-friendliness, location identification, data collection, and analysis to help the government agencies of SCO member states for decision making. While in the area of clean energy, I propose to explore the full potential of hydrogen energy for static and dynamic need. The major challenge in this direction is to develop novel materials (high efficiency, stability, sustainability, etc.) for hydrogen generation from water through electrocatalysis and photo-electro catalysis, which are promising approaches for it. As this area of research is at nascent stage and SCO nations can take a lead in this research domain. I also propose to explore potential of this energy source for rural sector.

Major awards/ Achievements:

1. INAE Young Engineer Award
2. SERB Women Excellence Award
3. Young Associateship, Indian Academy of Sciences

Possible collaboration with SCO countries:

With my basic expertise in area of materials engineering and focus towards environmental technologies, I propose to work on problem of common interest for SCO countries i.e. clean energy and water pollutants monitoring/degradation. There is unmet need to be addressed through technological/material science innovation in these domains. Besides, I propose to collaborate on decarbonization and air purification solutions through materials engineering and scaling.

Key words: Water, Sensors, Materials, Hydrogen, Pollutants, Degradation