INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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SHORT ABSTRACT

The environmental pollution has become a global issue catalyzed by the generation of multi-natured pollutants in the biosphere and demands immediate attention towards modification and advancement in existing abatement methods. In the last decade, presence of drug-based micropollutants in water and volatile organic compound (VOCs) in air have raised many questions about the efficiency of available treatment methods. Membrane technology is one of the emerging and advanced processes that can provide a sustainable solution to water and air pollution. However, there is an apparent requirement for modification in the existing membrane technology for rendering desired efficiency.

This doctoral thesis is a part of larger investigation of using Sericin as an adsorbent together with membrane technology for air and water purification. The first stage of research focused on establishing the potency of Sericin as a bio-sorbent for the removal of Ibuprofen as a model drug, from water. Sericin-Ibuprofen interaction was tested in an integrated adsorbent-membrane process. Sericin-Ibuprofen interaction is found to be spontaneous and endothermic in-nature, while the random coil transition of Sericin governed the adsorption system. Complete removal of Ibuprofen (at 10 mg/L, pH 8) was achieved using 10 g of Sericin (pH 4) and at a temperature of 40°C in reverse osmosis membrane process.

In the second stage of research, a novel and facile method of sericin coating on a hollow-fiber microfiltration membrane was devised. The modified adsorptive fouling resistant membrane was used for the removal of drug-based micropollutants from water. The modified membrane performed very

efficiently in multidrug mixtures and in presence of background salts. The dynamic adsorption behavior was predicted using the Bohart–Adams model with a minimum experimental error. During fouling resistance experiments around 10-15% less fouling was noticed for the sericin coated membrane with reduced reversible/irreversible fouling and high quality permeate.

In the final phase of research, a facile and novel method developed for the fabrication of polyester-based air filter via surface coating with Sericin for imparting effective removal of particulate matter (PM) and VOCS. The Sericin coated filter was able to remove the particulate matter, $PM_{2.5,}$ and PM_{10} (from 1000 $\mu g/m^3$ level to 5 $\mu g/m^3$ in a 6.28 m^3 chamber) within 27 and 23 min of operation, respectively. The fabricated filter very effectively removed particulate matter for 2160 cycles with intermittent washing. The Sericin-coated air filter also proved very effective for the removal of BTEX from an indoor chamber at a varying initial concentration of 100–1000 $\mu g/m^3$. The maximum adsorption capacity (mg/g) obtained with best-fitted Sips Isotherm fitting followed the order Xylene (6.97)>Ethyl Benzene (5.68)> Toluene (5.35) >Benzene (4.78). This work provides a detailed insight into the use of sericin for membrane modification using a facile and novel modification method for air and water purification.