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SASTRA University

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Nano-Bio-Sensors for Food & Water Quality Applications

In this era of globalization, consumers are aware of safety, quality and authenticity of the food products they purchase. From pre-historical times, consumers are paying great attention to the sensory characteristics like smell, taste and appearance of food items. Therefore, industries are forced to develop new technologies to meet the expectations of the consumers. In this scenario, nanostructured metal oxide thin films based gas / chemical sensors and nano-interfaced electrochemical biosensors have proved to be novel and rapid technologies to ensure food quality and food safety. In our laboratory, nano-bio-sensors have been developed for the detection of biomarkers namely, ammonia, hydrogen sulfide, ethanol, acetaldehyde, trimethylamine, histamine, xanthine, which can be used to assess the spoilage levels of milk, meat and fish in a qualitative and quantitative manner. Towards this work, various control parameters of spray pyrolysis and electrospinning techniques were optimized to obtain nanostructured ZnO thin films with desired characteristics. In specific, effect of synthesis and post annealing temperatures, morphology, grain size and shape, dopants on the sensing properties of ZnO thin film have been investigated. In addition, electrochemical biosensors with ZnO, CeO₂, [Ru(bpy)₃]²⁺-Graphene Oxide nano-interfaces were developed to detect ripening agent namely calcium carbide, adulterants like melamine, urea and hydrogen peroxide in milk. Also, sensors were developed to detect the presence of pesticides such as captan, carbosulfan, monocrotophos, tetrachlorodibenzodioxin, pentachlorophenol in apple, rice, orange, guar gum and water samples. Further, simultaneous detection of metal ions in groundwater samples has also been achieved. Development of these sensors with enhanced figure of merits has proved their commercial viability.