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Highly selective detection of different analytes with ZnO nanorods field-effect transistors array sensors

Yoon-Bong Hahn
Chonbuk National University, Republic of Korea

The development of multiplexed nanoscale chemical and biological sensors for simultaneous detection of different analytes is a major challenge at the nanotechnology frontier. It is well recognized that diabetes mellitus is a metabolic disorder resulting in an abnormal blood glucose level and activation of several metabolic pathways related to inflammation and apoptosis events. We have developed ZnO nanorods (NRs) based, integrated field-effect transistors (i-FETs) array biosensor with simultaneously immobilizing GOx, ChOx and Ur enzymes on three different ZnO NRs arrays. In this lecture, we reoprt a novel straightforward approach for simultaneous and highly selective detection of multi-alanytes (i.e., glucose, cholesterol and urea) with the i-FETs array biosensor without interference in each sensor response. Compared to analytically measured data, performance of the i-FETs array biosensor is found to be highly reliable for rapid detection of multi-analytes in mice blood, serum and blood smaples of diabetic dogs. The development of an integrated, low-cost ZnO NRs i-FETs array biosensor will produce quick detection under critical patient conditions, early identification of disease/disorder, and also have an enormous impact on the future generations.

ybhahn@jbnu.ac.kr

Organic nano-cube delivery system for sustained release of encapsulated skincare actives

Youssry Y Botros
PanaceaNano, Inc., USA

The method of delivery of the active skincare ingredient in a topical cosmetic formulation determines the efficacy of the product. A green nanotechnology based on a new class of porous, sponge-like nanomaterials called organic nano-cubes (ONCs) that are comprised of carbohydrate molecules has been employed in cosmetic formulations. Organic nano-cube materials are biodegradable, edible, and non-toxic. Not only can the organic nano-cubes host and encapsulate active ingredients, such as skincare, anti-wrinkle, and anti-aging cosmeceuticals, for protection from photodegradation, they act as nano-carriers to enhance the dermal and transdermal delivery of these ingredients. Organic nano-cubes release the cosmetic ingredients directly into the skin undamaged and at a controlled rate for long-lasting treatment without the side effects of skin irritation resulting from uncontrolled exposure. The capability of ONCs to retain and release skincare ingredients has been investigated. Based on the results obtained for several active ingredients tested, ONCs increase the ingredient release duration by 5x at a steady rate. It is believed that ONCs, loaded with active ingredients, act as reservoirs to store and steadily release guest ingredients and extend significantly the duration of therapeutic effect. Various types of nanomaterials have been used for improving delivery in cosmetic products, such as liposomes, nanoemulsions, and nanocapsules. ONCs comprise another class of nanomaterials that can be employed by the cosmetics industry. They are safe, bio-compatible, and have proved to be a versatile and viable platform for sustained release and enhanced delivery for a wide range of cosmeceutical ingredients.

youssry.botros@panaceanano.com