Biocomposite foams as rapid indicators for pH changes

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Abstract

Herein we present the development and characterization of foams composed of polyvinyl alcohol (PVA), microcrystalline cellulose (CMC) and anthocyanin directly extracted by red cabbage (brassica oleraceae) used as intelligent colorimetric pH indicators. As the physicochemical characterization reveals, the developed foams are highly porous (87%) with pores sizes ranging between 2.06 µm and 5.82 µm, while they absorb efficiently water and moisture. The introduction of the CMC as a filler in the skeleton of the foams results in the decrease of the water and moisture capacity uptake but it significantly increases the speed of the vapors adsorption since it contributes to the increase of the hydrophilicity of the system. Therefore, the biocomposite foams can rapidly change colour upon pH changes of solutions and vapours. In fact, the results for the optical/visual colour changes and UV-visible spectra of the foams revealed that the herein developed biocomposites are universal pH indicators, capable of sensing acidic, neutral or basic environments by displaying a distinct colour for each pH value, few seconds after the exposure (Fig.1). The colour change of the indicators is a simple visual method to detect the pH environment and can be used in various applications [1, 2]. In particular, having in mind that the metabolic products of the bacteria during the food spoilage can produce liquids of different acidity, such biocomposite foams can be used in intelligent food packaging as colorimetric food spoilage indicators [1]. Furthermore, since by monitoring the pH changes one can monitor the cells metabolism, such biocompatible and biodegradable porous pH indicators can be easily implemented in biomedical applications as active scaffolds for tissue growth while simultaneously monitoring the extracellular environment.

References

[1] I. Choi, J. Y. Lee, M. Lacroix and J. Han, Food Chemistry. **218**, 122-128 (2017)Reference 2
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Figures

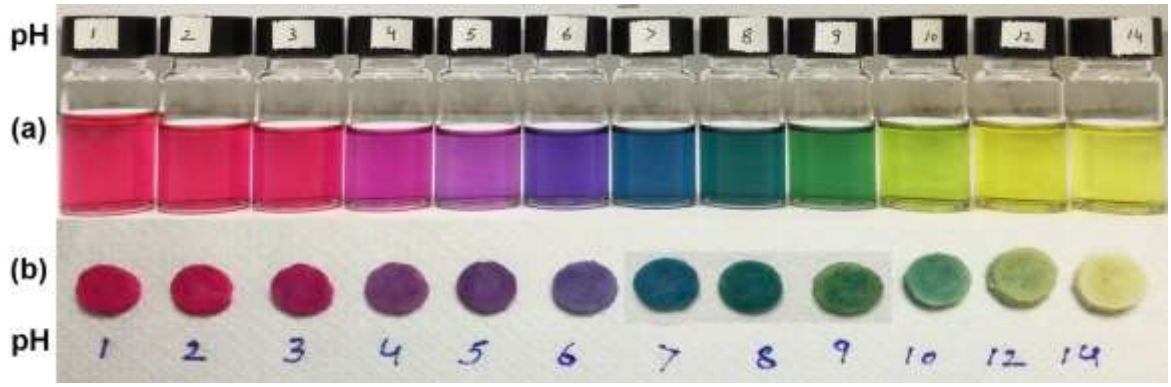

Figure 1. (a) Anthocyanin solution response upon pH changes (b) Anthocyanin treated PVA/Cellulose foams upon pH changes