

Área: ORG

Development of smart bandages based on sodium alginate and red cabbage anthocyanins

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Highlights

Development of smart bandages that detect changes in wound pH. Bandages based on sodium alginate and anthocyanins. An innovative approach covalently bonds the pigments to the polymer, thereby enhancing stability.

Resumo/Abstract

Chronic wounds pose a significant health challenge, and monitoring their healing is crucial to improving patients' lives. This project aims to develop smart bandages that detect pH changes, a key indicator of infection. The work focuses on the combination of anthocyanin extracts, natural pigments that change color with pH, and sodium alginate, a polysaccharide commercially used in bandages and other medical applications. The innovation here is the covalent binding of anthocyanins to alginate, which enhances their stability—a problem that previously limited the applicability of these pigments. The experimental process began with the extraction and concentration of anthocyanins from red cabbage. Sodium alginate modification reactions were tested using the EDC (1-Ethyl-3-(3-dimethylaminopropyl)carbodiimide) / NHS (N-Hydroxysuccinimide) system or protic acid catalysis, applying the extract, whether concentrated or not. After dialysis to remove the non-bound anthocyanins, the samples that used the concentrated extract in an acid medium maintained an intense coloration, indicating the presence of a covalent bond. The FTIR analysis confirmed the formation of new bonds, such as ester stretches (widening at 1600 cm^{-1}), which are characteristic of the modified material. To ensure the moisture resistance, the next step was the cross-link process. The crosslinking of modified alginate with calcium chloride failed to form a defined hydrogel. This probably occurred because the alginate carboxylate groups, essential for this crosslinking, were used in the binding with anthocyanins. Even in the presence of non-modified alginate, the cross-link was not effective. On the other hand, crosslinking with chitosan produced a thicker gel, and qualitative tests showed more intense color changes at different pHs than those observed with calcium chloride. Additional tests and analysis are being conducted to understand the role of chitosan in the process. New adjuncts, such as ascorbic acid (known as a copigmentant), are also being tested to improve stability and color differentiation.

The results to date demonstrate that a covalent bond between anthocyanins and alginate is possible. Although the formation of a commercial bandage with a defined shape requires further optimization, the material already exhibits a promising colorimetric response for indicating pH in wounds.

References:

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31º Encontro de Química da Região Sul- Unioeste – Campus Toledo

The banner features a dark teal background with a subtle pattern of molecular models and laboratory glassware. On the left, a molecular model with orange and white spheres is visible. On the right, another molecular model with red and white spheres is shown. The text is arranged in three columns. The first column contains the large number '31' in yellow, followed by 'ENCONTRO DE' in orange and 'QUÍMICA DA REGIÃO SUL' in white on a yellow rectangular background. The second column contains the subtitle 'A QUÍMICA COMO PROPULSORA DE NOVOS ECOSISTEMAS DE INOVAÇÃO' in white. The third column contains the dates and location '19 A 21 DE NOVOEMBRO Campus Toledo Unioeste' in white.

31 ENCONTRO DE
QUÍMICA DA REGIÃO SUL

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