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Organized Molecular Systems on the service of sustainable development

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PURPOSE OF THE ABSTRACT

The SMODD research group's originality is based on the technical know-how and synthetic engineering of innovative Organized Molecular Systems (OMSs), seeking new chemistry concepts with an implicit sustainable development background (renewable resources, green solvents, atom economy?). Our main strengths are the design and the formulation of original systems, with applications in different areas: pharmaceutics, agro-food technology and "green" materials.
Examples will be developed here to illustrate each area of application.
Green formulation and molecular economy: In several fields such as the dermo-cosmetic industry, the trend is towards the multiplication of ingredients. This complexity arises from an ever requesting need in versatile products, combining several properties. Such an ingredient profusion renders the formulation of these products complex and energy demanding. It can also lead to non-mastered ?cocktail? effects that can have consequences both on the health and the environment.
In response to that, we develop simplified formulations based on the concept of molecular economy. This concept will be illustrated by the synthesis of an anti-inflammatory based on a sugar-derived surfactant and its use in the development of already marketed dermo-cosmetic products. This double anti-inflammatory / surfactant property illustrates the relevance for polyvalent ingredients obtained from renewable resources, especially for the reduction of formulations' complexity.
Green formulation for the replacement of controversial ingredients: Palm oil is solid at room temperature but it melts in the mouth. It has no taste and do not go rancid, and its aspect does not change with temperature. Moreover, no conservatives or hydrogenation (a controversial process) are required when using it. Palm oil has it all for itself, and food industries use it a lot, from ready meals to pastry, including biscuits and spreads. Environmental consequences on tropical forests and their ecosystems are well known. To replace it, shea butter or coconut oil can be used but it is only shifting the problem. Other vegetable oils such as sunflower or peanut oils can be used., but they are less convenient and all of these solutions are often more expensive. Original green formulations of palm oil substitutes have been developed from oils produced locally.
Organogels as renewable materials from unmodified vegetable oils: Nowadays, the conversion of biomass products into useful materials has taken on considerable environmental and economic importance. In this context, vegetable oils offer significant opportunities for new green materials from renewable resources. Unfortunately, the synthesis of high-performance materials from this renewable resources requires important chemical modifications.

A simpler and cheaper way of transforming natural vegetable oil into a material involves gelation. Organogels are organic solvents or oils that have been gelled using an organic gelator. Organogels were prepared from soybean oil, gelled using different natural gelators. A controlled porosity was introduced by a particulate leaching method using water soluble porogens. Agglomerated sugar grains are used as a template, and after impregnation by the melted organogel and cooling, the water dissolution of the grains leads to connected pores inside the material. These microporous organogels can be used for example to analyse or remove pollutants from contaminated water.

FIGURES

FIGURE 1

FIGURE 2

KEYWORDS

Green formulation | Green materials | Renewable resources

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