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Study of the Sustained Release of the Thymus Fontanesii Boiss & Reut (Thyme) Essential Oil Stored In Modified Bentonite Supported on PVA for the Treatment of Bedsores

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ABSTRACT

The aim of this work is to develop a system with antiseptic activity capable of being active for a long time while releasing a constant, well-defined quantity. The system consists of the essential oil of *Thymus fontanesii* (thyme) incorporated in hydrophilic sodium montmorillonite and organophilic sodium montmorillonite respectively, and immobilized on polyvinyl alcohol as a polymeric support. The essential oil of thyme harvested in 2023, extracted by hydrodistillation using a clevenger with a yield of 2%, is essentially composed of thymol (%) and exhibits very marked antibacterial activities. The incorporation of the extracted essential oil into the sodium montmorillonite, as well as that modified by insertion of a hydrophobic group via reaction with CTAB, is clearly visible and identifiable on the FTIR spectra. The dispersion of hydrophilic and hydrophobic montmorillonite particles containing thyme essential oil on polyninyl alcohol is confirmed by FTIR and UV-Vis spectra. Monitoring of the release of Thymus fontanesii essential oil stored on montmorillonite particles fixed on polyvinyl alcohol in a skin-like atmosphere is optimal, and on the other hand antimicrobial tests justify their use as antiseptics.

Keywords: Thymus fontanesii, essential oil, hydrophilic and hydrophobic montmorillonite, antiseptic.

1 Introduction

The emergence of new forms of disease, the development of resistant forms of micro-organisms and the difficulties faced by patients in obtaining the necessary drugs and treatments are forcing researchers in the field to invest in finding, improving and developing new, more effective drugs and pharmaceutical forms. With this in mind, this work was initiated with the aim of using natural substances, namely essential oils, and in particular those rich in phenolic compounds known for their proven antimicrobial activities, such as that of thymus fontanesii. The ideal shaping of this essential oil to guarantee continuous activity throughout the entire treatment period without interruption requires storage of the essential oil in question in containers supported on a rigid matrix. For this reason, bentonite is an important resource for the preparation of sodium bentonite, known for its hydrophilic character, which after modification by the insertion of a cationic active tension is transformed into a hydrophobic and organophilic resevoir capable of storing larger quantities of essential oil. This modification of sodium montmorillonite is capable of providing continuous and prolonged relief of the infected area.

2 Experimental

Thymus fontanesii was identified by Dr. METAI Abdelkader, botanist at Blida 1 University, and its essential oil was extracted by hydrodistillation using a Clevenger. The essential oil of Thymus fontanesii was extracted by hydrodistillation using a Clevenger. The raw bentonite used in this work comes from the same batch extracted from the Roussel deposit (Maghnia-Algeria). The purification method consists in dispersing a 400 g mass of raw bentonite in 4 L of distilled water, under vigorous agitation for 8 h to remove all crystalline impurities (feldspar, quartz, etc.). Sodium homo-ionization is achieved by five successive treatments with a 1 M sodium chloride solution. Excess electrolyte is removed by repeated washing with distilled water. In this cycle of operations, each wash is carried out after 4 h of agitation, followed by 24 h of decantation. It

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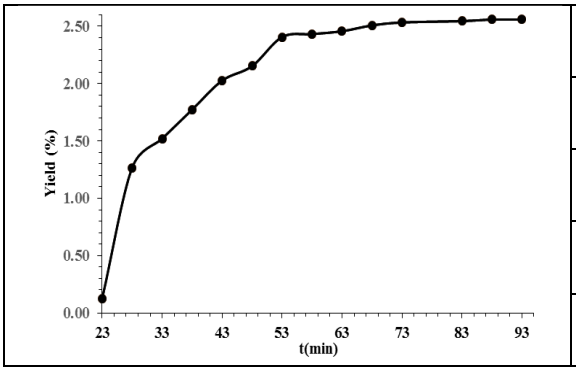
is then introduced into test tubes graduated at 2 L. After 8 h of rest, a distance of 10 cm is covered by the granulometric fraction Ø< 2 µ m. This fraction is aspirated with a Robinson Kohn pipette, then washed and centrifuged. Traces of residual salts are removed by dialysis through a semi-permeable cellulose acetate film (cellophane). After drying in an oven at 50°C for 4 days and grinding, sodium montmorillonite is obtained.

Organophilic montmonrillonite was synthesized according to the procedure described by Bhattacharya and Aadhar [1]. 5 g of dried sodium montmorillonite was dispersed under vigorous agitation for 24 h in 500 ml of distilled water at room temperature. A 0.03M solution of cetyltrimethylammonium bromide (CTAB) (1.09 g in 100 ml) was also prepared. This was added progressively to the previous solution under stirring for 12 h. The mixture was then filtered under vacuum and the resulting precipitate was stirred in 50ml distilled water for 4 h. The organophilic montmorillonite is then washed several times with distilled water to remove inorganic cations. The organophilic montmorillonite obtained is then dried at 60°C, ground and sieved.

3 Results and Discussion

The essential oil of Thymus fontanesii was obtained in appreciable yield over 90 min as shown in figure 1. and the phsico-chemical properties are summarized in table 1.

The insertion of the essential oil within sodium montmorillonite and organophilic montmorillonite is confirmed by FTIR analysis, as shown in Figures 2.



Density (g/cm3)	0.9399
Refractive index	1.5100
Saponification value	22.13
Acid value	12.29
Ester index	9.84

Figure 1: extraction kinetics

Table 1: physicochemical characterization of essential oil).

4 Conclusions

The results obtained confirm the insertion of the essential oil of Thymus fontanisii within organohilic montmorillonite compared with sodium hydrophilic montmorillonite, and the release tests are in perfect agreement.

References

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