New Extraction Technique for Alkaloids

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A method of extraction of natural products has been developed. Compared with existing methods, the new technique is rapid, more efficient and consumes less solvent. Extraction of alkaloids from natural products such as Hyoscyamus muticus, Datura stramonium and Ruta graveolens consists of the use of a sonicated solution containing a surfactant as extracting agent. The alkaloids are precipitated by Mayer reagent, dissolved in an alkaline solution, and then extracted with chloroform. This article compares the results obtained with other methods showing clearly the advantages of the new method.

Keywords: alkaloids, extraction, sonication, surfactants, Mayer reagent
apparatus for 18 h. The final extract was filtered and the filtrate was concentrated under vacuum. The residue was treated in the same manner as described for the maceration method (see above).

**Principle of the new method**

A sample of 10 g of powdered plant material was suspended in 400 mL of surfactant solution in a glass beaker and sonicated for 2.5 h in an ultrasonic bath at a constant temperature of 25 °C. The extract was separated by simple filtration and the residual material washed with 20 mL of pure water. The solution of combined filtrates was acidified with sulfuric acid solution (2%, m/m) to pH 3-4 and the alkaloids were precipitated with 15 ml of Mayer reagent. The precipitate was dissolved in an alkaline solution of sodium carbonate (5%, m/m) and extracted with CHCl₃. The organic layer was washed with water to neutral pH, dried with Na₂SO₄ and concentrated to dryness under reduced pressure to obtain alkaloids.

Thin layer chromatography, IR and UV were used to compare crude alkaloids obtained by the different procedures. All samples presented the same qualitative profile.

**Results and Discussion**

Preliminary experiments set were performed with sonication of powdered leaves of *Datura stramonium* in surfactant solution of sodium dodecylsulfate 0.1% (m/v) at room temperature to determine the best extraction time. The collected results (Figure 1) showed that the highest yield was achieved by this method after 2.5 h with no significant variation. All experiments were duplicated and this time was selected, as standard.

The following experiment was made to choose between an anionic (SDS: Sodium dodecylsulfate, Aldrich product) and a non-ionic surfactant (Emulgen: Polyethylene glycoldodecyl ether, Aldrich product) and to determine the effects of surfactant concentration on the extraction. The results (Figures 2 and 3) showed that the presence of surfactant enhances the amount of total alkaloids extracted even at low concentration (0.01%, m/v). Moreover, no significant difference was observed between the two types of surfactant.

It appeared that more the total alkaloid contained in the plant material, the higher the concentration of surfactant required to extract it in high yield.

A concentration of 0.2% (m/v) of surfactant was selected to compare this new method and the classical one.

The collected results (Figure 4) concerning the comparison between conventional extractions (soxhlet and room temperature solvent extraction) and the extraction of the three plants under study in the presence of surfactant, showed the following points: In all cases, SDS or Emulgen lead to the same results; in the case of *Datura stramonium*, there is no significant variation between the different extraction methods; in the cases of *Ruta graveolens* and *Hyoscyamus muticus*, the use of surfactant results in a better extraction of total alkaloids.
Conclusions

The study carried out, confirms that the method using surfactants in the extraction of alkaloids is more efficient, the alkaloids recovered having similar qualitative characteristics of those obtained by conventional extraction methods. The method is a useful alternative technique and can probably be expanded to other secondary metabolites (essential oils and polyphenols are in the course of study). To make this method more universal will require optimisation of parameters such as temperature, nature of surfactants, volume and concentration of surfactant solution.

References


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