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EXTRACTION OF ALKALOIDS OF *Catharanthus roseus* INTO INTERLAYER NANOSPACES OF CATION-EXCHANGED MONTMORILLONITE CLAYS

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Montmorillonite (MMT) clays are layered aluminosilicates with expandable interlayer nanospaces (1-3 nm) in which exchangeable cations are found. Such cations being readily exchangeable, enables various cation-exchanged MMT clays with Bronsted and Lewis acidities to be prepared. Because of the presence of endogenous nanoscale interlayer cavities with an acidic environment, the cation-exchanged MMT clays may be used as solid acids to trap alkaloids from natural sources (e.g. plants), and also to intercalate alkaloids of pharmaceutical or agricultural importance for subsequent release as appropriate in applications. Alkaloids are usually obtained from natural sources by extraction into aqueous acids or organic solvents of varying polarity, followed by solvent partitioning and chromatographic fractionation. Here we exemplify with *Catharanthus roseus* L (Apocyanaceae) the potential application of cation-exchanged MMT clays as solid acids to trap alkaloids from plant extracts. *C. roseus* contains many indole alkaloids including vincristine and vinblastine, the anticancer drugs used in the treatment of leukaemia.

Dichloromethane and methanol extracts of leaves of *C. roseus* were separately treated with H⁺- and Al³⁺-exchanged MMT. The treated MMT clays were examined by FT-IR, XRD, TGA and DSC. The alkaloids present in the original extracts and the respective supernatants obtained after treatment of the extracts with the clays were analysed by TLC (Draggendorf's reagent) and UV-Vis absorbance at 427 nm of the ion-pair complex formed with methyl orange at pH 4.5. The H⁺-exchanged MMT treated with the dichloromethane extract, was stirred with 0.5 M NaOH for 2 and 16 h, the respective mixtures extracted into ethyl acetate, and the organic extracts analysed by TLC and ion-pair formation.

The TLC of the supernatants lacked the coloured spots observed for the original extracts indicating that the alkaloids had been removed from the extracts by the clays. The absorbance values at 427 nm of the ion-pair complex confirmed 100% removal of alkaloids. The FT-IR bands (1600-3600 cm⁻¹), DSC exothermic peaks (300-550 °C) and XRD data of the treated MMT clays were consistent with the intercalation of alkaloids into the interlayer gaps of the clays. The clay composite of H⁺-MMT and dichloromethane extract, upon stirring with 0.5 M NaOH, released 30% and 53% of the alkaloids at 2 and 16 h respectively, as evident from the analysis of ion-pair formation.

The present study demonstrates that alkaloids can be successfully intercalated from *C. roseus* extracts into cation-exchanged MMT and subsequently released. Similar studies with other plant extracts and bioactive alkaloids are in progress.