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Note

The role of sepiolite and palygorskite on the migration of leukocyte cells to an inflammation site

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ABSTRACT

Sepiolite and palygorskite have shown beneficial health effects but understanding human cell-clay interactions has yet to become unveiled. This paper reports on the effects of sepiolite (Vallecas, Spain) and palygorskite (Torrejon El Rubio, Spain) on the infiltration of human blood leukocytes to an infiltration site. Quantification of human blood leukocyte cells under pro- and anti-inflammatory conditions was conducted, and cells visualized in an Axioscope (Carl Zeiss; Oberkochen, Germany). Images were recorded with an Axiocam Mrm monochromatic camera and ZEN Pro software (Carl Zeiss). The distribution of human blood leukocyte cells at the inflammation site varied before and after adding the clay. The relative proportion of PMN-to-monocytes(MN) (PMN/MN) exposed to the inflammatory activity by 12-*O*-tetradecanoylphorbol-13-acetate (TPA) changed in the presence of sepiolite (TPA + sepiolite) or palygorskite (TPA + palygorskite) either after 4 or 24 h, namely, 0.60, 2.5, and 2.33; and 4.33, 1.53, and 2.8, respectively. PMN/MN values compared in the presence of TPA or TPA and palygorskite, however decreased sharply in the presence of TPA and sepiolite. Proposedly, decreases in PMN/MN values caused by adding sepiolite may alter PMN and MN immunological functions, by lessening the destruction extent of invasive bacteria via phagocytosis and the conversion of MN to macrophages. Proposedly, limiting a conversion of MN to macrophages impedes resolving inflammation because of an incomplete digestion of aged cells. Evidently, shifting from pro- to anti-inflammatory conditions due to the addition of the clay altered the mechanism of infiltration of different leukocyte cells to an inflammation site. Finally, the presence of few macrophages at the inflammation site was attributed to resolution of inflammation, whereby macrophages participated in anti-inflammatory mechanisms leading to the return to homeostasis in tissues.

1. Introduction

Sepiolite and palygorskite have shown beneficial health effects but understanding human cell-clay interactions has yet to become unveiled. These clays can act as an effective anti-inflammatory, while they limit growth of human cancer cells (Cervini-Silva et al., 2015a); and inhibit oxidative stress by owing an intrinsic strong oxidant (or weak anti-oxidant) activity (Cervini-Silva et al., 2015b). To the authors' knowledge, however, little information has become available on how the structural and textural properties of these clays may alter the migration of leukocyte cells to an inflammation site. This paper reports on the effects of well-characterized sepiolite (Vallecas, Spain) and palygorskite (Torrejón El Rubio, Spain; García-Romero and Suarez, 2010) on the infiltration of human blood leukocytes to an infiltration site. To this end, cells were exposed to inflammatory conditions using 12-*O*-tetradecanoylphorbol-13-acetate (TPA), then either sepiolite or palygorskite was added. After 4 or 24 h, edema in mice ears was compared.

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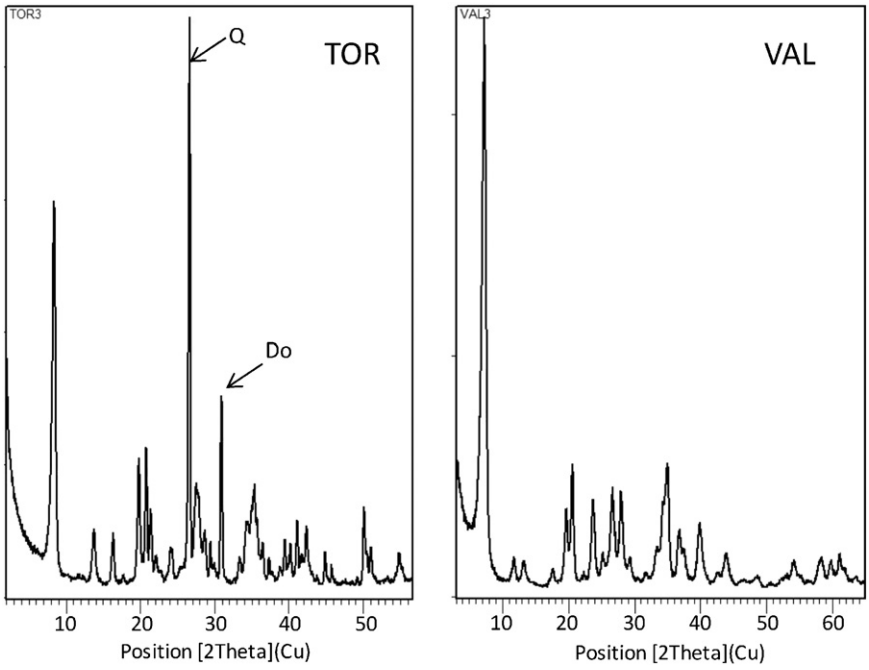

Fig. 1. X-ray diffraction patterns of TOR (left) and VAL (right) samples.

2. Materials and methods

2.1. Sepiolite and palygorskite

Two different clay minerals were selected in these experiments: sepiolite and palygorskite. Sepiolite and palygorskite used come from two Spanish deposits: sepiolite from Vallecas (VAL sample) and palygorskite from Torrejón el Rubio (TOR sample). VAL is a very pure sepiolite (Fig. 1) while TOR contains small amounts of quartz (~20 wt.%) and dolomite (<5 wt.%) as impurities. The mineralogical, crystal chemistry, and textural characterization of these samples have been previously reported (García-Romero and Suarez, 2010, 2013; Suárez and García-Romero, 2012).

Mineralogical characterization was performed via X-ray diffraction (XRD) using a Siemens D500 XRD diffractometer equipped with a Cu-Kα radiation source and a graphite monochromator. Textural analyses were performed from the corresponding nitrogen adsorption–desorption isotherms at −196 °C obtained from a static-volumetric apparatus (Micromeritics ASAP 2010 adsorption analyser).

2.2. 12-O-tetradecanoylphorbol-13-acetate (TPA) method

Experiments were conducted in adult male CD-1 mice (20–25 g) approved by the Animal Care and Use Committee (NOM-062-ZOO-1999) provided by the Instituto de Fisiología Celular, UNAM, and maintained at 25 °C on a 12/12 h light–dark cycle with free access to food and water. Determinations of the mice ear edema using TPA as inflammatory agent were conducted according to methods described elsewhere (Merlos et al., 1991; Cervini-Silva et al., 2015a). A parallel set of experiments with commercial indomethacin as anti-inflammatory was

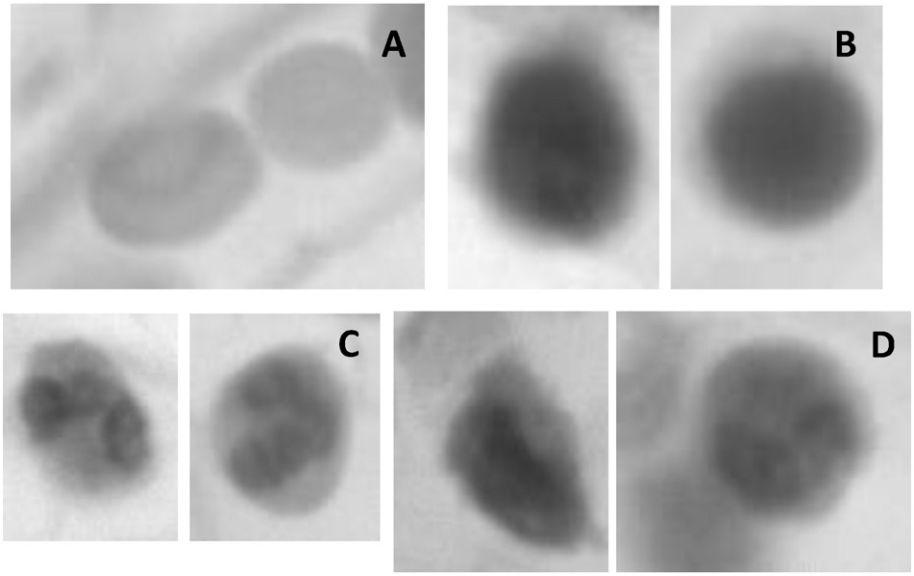

Fig. 2. Optical micrographs of leukocyte cells: (A) erythrocytes, (B) lymphocytes, (C) neutrophils, and (D) monocytes.