

UV Protection Ability of Latvian Illite Clays

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I. INTRODUCTION

UV radiation is well known for its harmful effect on human health and can cause sunburn, premature skin aging and skin cancer. There are three types of UV radiation: UV-A causes sunburn and skin aging, UV-B may cause DNA damage and skin cancer, UV-C is the most dangerous, but it is generally absorbed by the ozone layer.

Both organic and inorganic compounds are being used in sunscreens as UV filters. From inorganic compounds TiO₂ and ZnO are the most used, but they can cause an unexpected photo-catalytic effect and damage the skin [1, 2], while organic UV filters can cause allergic reactions [3]. Therefore one of the potential candidates as natural UV filters in sunscreens are clays and clay minerals, due to their positive impact on human health and chemical inertness [4]. Recent research shows that clays have the UV protection ability due to their high specific surface area, therefore providing effective coverage of skin surface. The magnitude of UV protection depends on the clay mineralogical composition [1, 5].

The aim of this study was to determine UV protection ability of Latvian illite clays and to evaluate their possible application in sunscreens as UV filters.

II. MATERIALS AND METHODS

Clay samples with different mineralogical composition and colour from five sites in Latvia were used. Few samples were purified from: 1) carbonates by dissolution in 1M citric and hydrochloric acids solutions and 2) iron oxides by reduction in sodium dithionite. Clay fraction < 2 μm was used.

For UV transmittance measurements clay/glycerol suspensions with clay concentration 20 and 30 wt% were made. UV-VIS spectrophotometer Evolution 300 was used. Each sample was applied on a quartz glass in the amount of 0.14 mg/cm², spread evenly with an ungloved finger and let to dry for 20 minutes. From the obtained results, SPF (sun protection factor) values were calculated. To evaluate the obtained results, three commercial sunscreens with different SPF values were used.

III. RESULTS AND DISCUSSION

Results in Figure 1 show that after clay purification UV transmittance increases, which means that UV protection ability decreases. The highest increase of UV transmittance (approximately 1.3 to 1.4 times) was observed for samples after removal of iron oxides. T. Hoang-Minh et al. obtained similar results [1], explaining it with electron configuration of iron oxides. In electron configuration of Fe³⁺ there is an empty orbital that can absorb energy. Therefore the presence of iron oxides increases the UV protection ability. Figure 2 shows the variations in UV transmittance of untreated Latvian clays in comparison with commercial sunscreens.

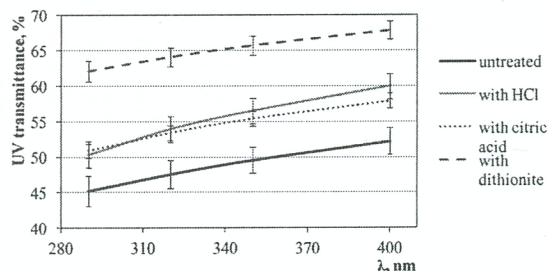


Figure 1. UV transmittance of Laža clays before and after purification (clay concentration 20 wt%)

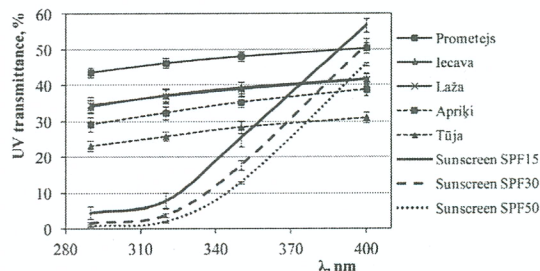


Figure 2. UV transmittance of some untreated Latvian clays (clay concentration 30 wt%) and sunscreens with various SPF values

REFERENCES

- [1] T. Hoang-Minh et al., *Appl Clay Sci*, **2010**, 48, 349–357
- [2] T.G. Smitjs, S. Pavel, *Nanotechnol Sci Appl*, **2011**, 4, 95–112.
- [3] Z.A. Lewicka. The characteristics of nanoscale sunscreen particles. *Doctoral thesis*. **2009**, pp.86.
- [4] K. Nallis, *Appl Clay Sci*, **2013**, 80–81, 147–153.
- [5] T. Hoang-Minh et al., *Appl Clay Sci*, **2011**, 53, 66–72.