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DEVELOPMENT OF EXFOLIATED NANOCLAY IN PP MATRIX ASTHE SHEATH MATERIAL FOR TEMPERATURE-REGULATING BICOMPONENT FIBERS

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One of the original purposes of the invention of clothing is to help the body stay in the comfortable temperature at varying physical activity levels and different temperature fluctuation conditions. But, in some situations, it would be unpleasant to wear too much clothing, while taking off clothing could make the body feel uncomfortable. It would be most ideal if the clothing itself could regulate the temperature.

For example, at high temperature, the clothing can absorb the excess heat produced by the body or ambient environment and store it inside the clothing system; while when temperature drops, the stored energy can slowly release to warm up the body. This goal could be achieved by the development of temperature-regulating biocomponent fibers.

Fig.1a schematically shows the general structure of a temperature-regulating fiber. The core materials contain phase change materials (paraffin wax), which possess a high heat of fusion and are capable to store and release large amount of energy during their physical state change, and the sheath material here is polypropylene (PP). One of the advantages of the development of temperature-regulating biocomponent fiber is that a high temperature regulation efficiency can be achieved since a large amount of PCM materials can be incorporated inside the fiber. However, due to the good compatibility between paraffin wax and PP, the paraffin wax molecules can diffuse out from polymer sheath, which leads to a decrease of temperature efficiency as time goes on. To prevent the leakage of paraffin wax, the nanoclay was incorporated into the sheath. The nanocaly/polymer composites show superior mechanical properties, reduced gas permeability and flame retardancy, especially nanoclay in an exfoliated stated in the polymer matrix.[1] In our work, a good nanoclay exfoliation in PP matrix was achieved by using maleic anhydride grafted PP as compatabilizer, as indicated in Fig. 1b. The spinnability of this exfoliated nanoclay/PP composite as sheath material will be tested in the following time.

Reference

1. Galgali G. *et al*., Macromolecules, 2001, 34, 852-858