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Incorporating layered clay of Okanda and Kirinda ores into a poly (vinyl alcohol) matrix

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One of the eye catching areas in modern material science is the polymer nanoclay composites. Most of the local nanoclay demands are satisfied by imported materials. Sri Lanka is a country which is full of mineral resources including nanoclay. Clay is commonly used as a filler to enhance the polymer properties. As a result of composite formation, polymer will gain high barrier properties, chemical resistivity as well as an improvement in mechanical properties. This study was carried out to confirm the utility of such fillers in polyvinyl alcohol polymers. Raw soil samples were collected from Kirinda (81.2228 E, 6.2060 N) and Okanda 81.77092 E, 6.67650 N) areas at 50-70 cm depths. The collected clay samples were dried and subjected to a basic physical purification procedure. After confirming the presence of MMT type layered clays in local clay samples by XRD, these samples were subjected to further purification using sodium hexametaphosphate to remove quartz and other impurities. The chemical procedure was a trial and error method. The best purification cycle was selected by carrying out XRD and FTIR analysis after each stage of purification. The best purification level of layered clays was observed after one purification cycle with sodium hexametaphosphate.

Modification of partially purified layered clay was carried out to overcome the incompatibility between the PVA and the clay fillers. As the modifiers, 6-aminohexanoic acid and octadecylamine with 11-Aminoundecanoic acid were selected to do the comparison between the modifiers. Octadecylamine and 11- aminoundecanoic acid were used to give a co-treatment for the clay surface. Intercalation of modifiers to local and commercial layered clays was confirmed using XRD and FTIR studies. After confirming the intercalation of the modifiers, they were mixed with PVA. Composites of PVA and organically modified clay were prepared using the solvent intercalation method. The characterization of commercial and local clay PVA composites were carried out using XRD and FTIR. XRD studies showed that for all composites, the degree of crystallinity was improved compared to virgin PVA matrix. Additional diffraction lines due to crystalline domains appeared around 20° of XRD spectra. Differential Scanning Calorimetry (DSC) studies confirmed the presence of more crystalline domains in the polymer composites compared to pure polymer. In addition, DSC studies confirmed the improvement of the melting temperature of all clay composites compared to virgin PVA matrix.

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