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Structural, Porosity and Morphological Changes of Montmorillonite Derived Porous Clay Heterostructures Prepared by the Starch Gel Template Method

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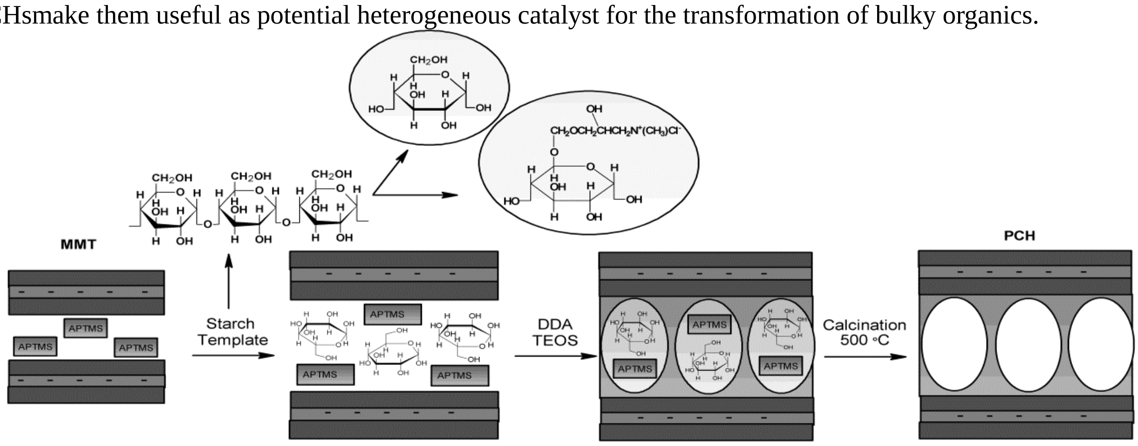
Clay minerals are natural hydrous aluminosilicate and possess a layered silicate structure that can be found in a number of soils. Montmorillonite (MMT) is one of the clay minerals have a surface area of 191 m^2g^{-1} and has been used as a catalyst and adsorbent. However, their efficient use is limited due to low thermal stability and lack of porosity[1-3]. In this work, mesoporous materials derived from raw MMTwere obtained using the starch gel template method. Porous heterostructures (PCHs) were prepared by intercalation of cationic potato starch and hydrolysed potato starch as template, dodecylamine as co-template and tetraethylorthosilicate (TEOS) as silica pillar into the interlayer space of MMT. The effects of starch loading and aging temperature on changes of the structure, porosity and morphology of MMT in the formation of PCHswere investigated. The MMT derived PCHswas characterized by means of XRD, N_2 adsorption-desorption, pyridine adsorption, FESEM and FTIR spectroscopy. The XRD and FESEM analyses of the PCHs prepared using cationic and hydrolyzed starchshowed a significant disordering of the MMT layer arrangement after treatment with the starch gel template. However, results of the nitrogen adsorption measurement showed the surface area has increased remarkably as high as 1000 m^2g^{-1} with average pore diameters of 3.4 – 3.8 nm and pore volumesof 0.70 to 0.87 cm^3g^{-1}. Furthermore, the structural integrity of PCHs deteriorated slightly with increasing temperature but the porosity was maintained until up to 900 °C. The FTIR spectra after pyridine adsorption showed thatboth raw MMT and PCHspossessed mainly strong Lewis acid sites. The acidity properties and high surface area of PCHsmake them useful as potential heterogeneous catalyst for the transformation of bulky organics.



Scheme 1 Proposed Mechanism of the PCHs synthesis

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