

VOPO₄·2H₂O and the vanadium phosphate catalyst produced by sonochemical synthesis

ABSTRACT

Six vanadyl phosphate dihydrate were prepared via sonochemical synthesis with different duration of time, i.e. 15, 30, 45, 60, 90 and 120 min are denoted as DS15, DS30, DS45, DS60, DS90 and DS120, respectively. DS120 were chosen as starting material to further proceed to form VPO catalyst through conventional reflux method. The synthesized materials were characterized by X-ray diffraction (XRD), scanning electron microscope (SEM), transmission electron microscope (TEM) and temperature-programmed reduction (TPR) in H₂. Catalytic evaluation of the sonochemical treated VPO catalyst, VPDS120 was also studied on microreactor. From the XRD patterns of the vanadyl phosphate dihydrate obtained, VOPO₄·2H₂O, via sonochemical synthesis in different duration of time are perfectly matched with the standard VOPO₄·2H₂O, indicating the high purity of the VOPO₄·2H₂O produced through this sonochemical synthesis technique that have been drastically reduced the synthesis time to only 15 min compared to the conventional reflux method that consumed the synthesis time up to 24 h. VPDS120 catalyst shows a drastically increment in the percentage of n-butane conversion compared to conventional VPD catalyst. This phenomenon occurred majorly due to the VPDS120 catalyst produced has smaller diameters and thickness of platelets that directly increase the active site of the catalyst for oxidation of nbutane. Furthermore, VPDS120 catalyst contain more V⁴⁺ percentage which also directly lead to the increment of the total amount of active and mobile oxygen attached to V⁴⁺ phase (O--V⁴⁺ pair).

Keyword: Sonochemical synthesis; Vanadyl phosphate dihydrate; Butane oxidation