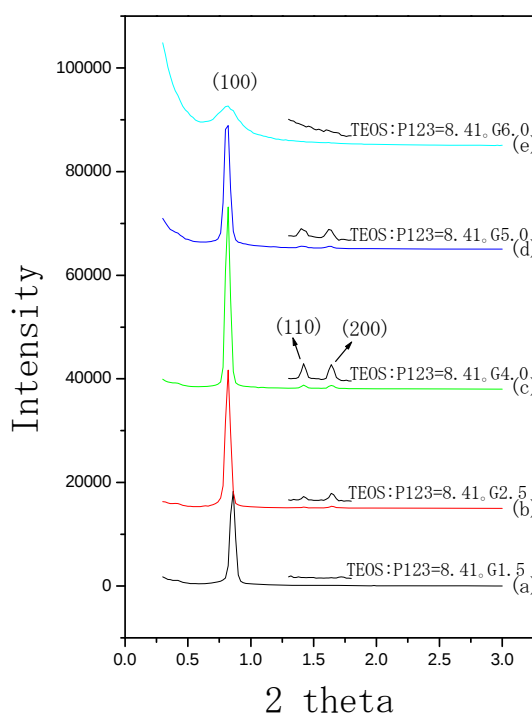


## Green Technology Synthesis of SBA-15 Nanoporous Material and Its Application in Chromatographic Column

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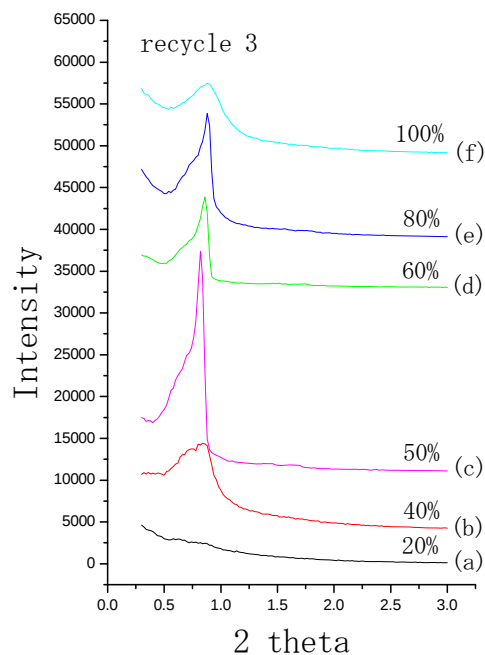
Polymer surfactants as the template and strong acid as the interface for the charge balance were used to synthesize mesoporous materials of SBA series. The polymer template was burned off and the mineral acid was neutralized or discarded. Therefore, most syntheses were not environmentally friendly. A new strategy to prepare SBA-15 nanoporous materials was coined "Green technology synthesis of nanoporous materials". The polymer and minerals acid were reused as the template and charge interface for the syntheses of nanoporous materials.



**Figure 1.** XRD patterns of SBA-15 samples synthesized with different TEOS/surfactant(P123) ratios, TEOS : P123 = (a)8.41 : 1.5, (b)8.41 : 2.5, (c)8.41 : 4.0, (d)8.41 : 5.0, (e)8.41 : 6.0

The XRD patterns in Figure 1 show XRD patterns of SBA-15 samples synthesized with different TEOS/surfactant (P123) weight ratios. The main Bragg reflections in the range of  $0.50 < 2\theta < 3$  can be indexed as (100), (110) and (200) hexagonal diffraction patterns. The XRD patterns have shown that the 100 reflection intensity increased slightly when P123 ratios increased from 1.5 to 4. It can be observed in figure 1, the sample prepared with TEOS/P123 ratio= 8.41 : 4 has two sharply well defined 110 and 200 reflections. This suggests that sample prepared with TEOS/P123 ratio of 8.41 : 4 has a long ordering of hexagonal pore arrays. When the P123

ratio increases gradually from 5 to 6, (110), (200) diffraction peaks of samples are gradually weakening and disappear, respectively.



**Figure 2.** XRD patterns of calcined SBA-15 sample prepared from the filtrate of recycle 4 and resupplied with different weight percentage of surfactants, (a) 20%, (b) 40%, (c) 50%, (d) 60%, (e) 80% and (f) 100%.

The diffraction peak intensity was decreased sharply when sample prepared by using first recycling filtrate (sample denoted as Recycle 1). Nevertheless, the hexagonal mesostructure of Recycle 1 sample is still maintained. When sample synthesized by using the recycling filtrate from first recycled sample solution (denoted as Recycle 2), the XRD patterns demonstrated that the hexagonal mesostructure of sample from second recycled sample solution was collapsed. It can be considered that the residual P123 concentration of Recycle 1 filtrate is not enough to develop the SBA-15 hexagonal mesostructure. Herein, we provided a strategy resupplying additional P123 surfactant to the recycling filtrate. The XRD patterns of calcined SBA-15 samples prepared with third time recycled filtrate (Recycle 3) and resupplying different weight percentages of surfactants shown in Figure 2. The XRD patterns reveal that the additional P123 surfactant can aid the SBA-15 nanoporous structure formation, even though 50% of original P123 was added into mother solution. Products for recycle 3 can still maintained moderate hexagonal mesostructure.