FORMATION OF PROPIONITRILE AND ACRYLONITRILE FROM ACETONITRILE AND METHANOL

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Cesium zeolite forms obtained by ion exchange catalyze the synthesis of ethylbenzene and styrene from toluene and methanol [1, 2]. We are the first to show that such catalysts prepared by impregnating NaY zeolite display activity in the synthesis of propionitrile and acrylonitrile from acetonitrile and methanol.

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The acetonitrile conversion at 450°C, atmospheric pressure, and 1 h⁻¹ volumetric rate of the 2:1-1:4 (mole ratio) acetonitrile-methanol mixture was 3-23%, while the total yield of nitriles relative to acetonitrile was 3.6-22.2%. The total yield of nitriles relative to methanol was 5-10.2%. In the case of the optimal 1:2 CH₃CN:CH₃OH ratio, the selectivity relative to acetonitrile was 96% and the selectivity relative to methanol was 64%. We should note that, in addition to propionitrile, small amount of acrylonitrile are also formed (see Table 1).

CH ₃ CN : CH ₂ OH (mole)	K _{CH3CN} , %	Yield wrt GH3CN, %		Yield wrt CH ₃ OH, %	
		C ₂ H ₅ CN	C ₂ H ₃ CN	C ₅ H ₅ CN	C_2H_2CN
2:1 1:1 1:2 1:3 1:4	3.0 6.0 23.0 15.0 20.0	3.6 5.4 20.8 14.5 16.3	- 1.4 0.4 3.6	7.3 5.4 9.6 3.3 4.1	0.6 0.1 0.9

TABLE 1. Reaction of Acetonitrile and Methanol to Give Nitriles

The catalysts were prepared by impregnating NaY zeolite with aqueous Cs_2CO_3 with subsequent roasting in the air at 400°C, CsNa 0.6 mole. The synthesis of the nitriles was studied in a catalytic flow system with a quartz reactor. The products were analyzed by gas-liquid chromatography.

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