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Microwave-activated Coupling Reaction on Polyethylene Glycol

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Abstract: The two-step Sonogashira coupling reaction took place rapidly under microwave activation conditions. PEG bound substrates acted as PTC and polymer support as well. Its yields are 80~90% and the products are in high purity.

Keywords: Microwave-activated, coupling and cleavage, PEG liquid-phase.

The liquid-phase synthesis of small organic compounds on soluble polymers has been the preferable strategy. It has both the advantages of liquid-phase and solid-phase methods[1]. One particular attractive field is the coupling reaction with the solvent-free phase-transfer catalysis (PTC) in microwave activation[2]. Recently, it has been reported that PEG bound substrates could play the role of PTC in some reactions[3], here we reported the first example of the microwave activated Sonogashira reaction under the solvent-free condition using PEG 4000 as the PTC and polymer support **(Scheme 1).**

Scheme 1

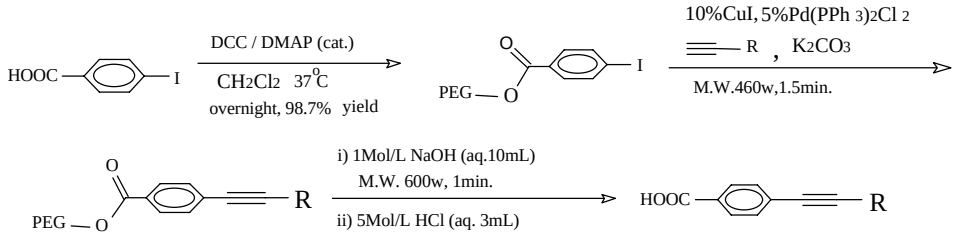

Table 1 (entries 1, 3) showed that the microwave method could shorten the coupling reaction time dramatically (from 3 h to 1.5 min), the yields of products were approximately equal though. For the entries 3 and 2 (**Table 1**), one could find that the yields of product were also improved significantly, when PEG 4000 supported 4-iodobenzoic acid was used as the substrate. In the coupling reaction, PEG 4000 acted as the solid-liquid PTC and polymeric support as well. Our study indicated that microwave radiation was also efficiently for the cleavage of products from PEG support. The cleavage proceeded very fast just in one minute, while it took 5 hours at 50°C for the traditional heating method. To our knowledge, there is no report on the cleavage of

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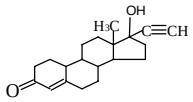
products from PEG support by microwave activated method.

Table 1 Microwave activated coupling and cleavage reactions on PEG 4000 support [a]

Entry	alkynes	Yield (%)[b]	Purity (%)[c]	^{1}H-NMR (500MHz, $CDCl_3$)[f] δ_{ppm}
1[d]	HC≡CCH$_2$OH	91		
2[e]	HC≡CCH$_2$OH	68		
3	HC≡CCH$_2$OH	89	93.90	1.80 (br, 1H, OH), 4.40 (s, 2H, CH_2) 7.54 (d, 2H, J=8.3Hz, ArH), 8.06 (d, 2H, J=8.3Hz, ArH)
4	HC≡CPh	94	95.45	7.47(m, 2H, PhH), 7.57(m, 3H, PhH) 7.64(d, 2H, J=8.5Hz, ArH), 8.11(d, 2H, J=8.5Hz, ArH)
5	HC≡CC$_4$H$_9$	87	~100	0.96 (t, 3H, J=7.2Hz, CH_3), 1.49 (m, 2H, CH_2) 1.61 (m, 2H, CH_2), 2.45 (t, 2H, J=7.2Hz, CH_2) 7.49 (d, 2H, J=8.5Hz, ArH), 8.03 (d, 2H, J=8.5Hz, ArH)
6[g]	norethindron	85	------	0.98(s, 3H, 13α–CH_3) 0.88~2.41(m, 24H, OH and bond-H), 5.85 (s, 1H,), 7.48(d, 2H, J=8.5Hz, ArH), 8.04 (d, 2H, J=8.5Hz, ArH)

a. the coupling and cleavage reactions were carried out under microwave heating without additional solvent; b. based on the original loading capacity of PEG 4000 with 0.5 mmol/g; c. based on the analysis of GC; d. the coupling with 4-iodobenzoic acid was carried out in CH_3CN under traditional heating at 40°C for 3 hours; e. the coupling with 4-iodobenzoic acid was carried out on silica gel under microwave heating; f. The proton signal of COOH could not be checked;

g. norethindron = 

References

1. P. Wentworth, K. D. Janda, *Chem. Commun*., **1999**, 1917.
2. S. Deshayes, M. Liagre, A. Loupy, J. L. Luche, A. Petit, *Tetrahedron*, **1999**, *55*, 10851.
3. C. G. Blettner, W. A. Konig, W. Stenzel, T. Schotten, *J. Org. Chem*., **1999**, *64*, 3885.

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