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SULFURATED BOROHYDRIDE EXCHANGE RESIN: A NOVEL REAGENT FOR SELECTIVE REDUCTION OF ALDEHYDES

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SULFURATED BOROHYDRIDE EXCHANGE RESIN: A NOVEL REAGENT FOR SELECTIVE REDUCTION OF ALDEHYDES

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ABSTRACT

Selective reduction of aldehydes is carried out by using sulfurated borohydride exchange resin as a novel reducing reagent. Other sensitive groups like F, Cl, Br, NO₂, CN, OMe, ester and methylenedioxy remain intact under these reaction conditions. The isolation of pure products by simple filtration and evaporation is an important feature of this method.

The high chemoselectivity, recovery and reusability of polymer supported reagents¹ over non-supported reagents² have prompted us to employ sulfurated borohydride exchange resin (SBER) as a novel and selective reducing reagent for aldehydes (Scheme).

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A series of substituted aldehydes were subjected to SBER in methanol at 25° C to get corresponding alcohols. The results are presented in table. It is important to note that SBER chemoselectively reduces aldehyde group in the presence of other sensitive functional groups like F (entry1), Cl (entry 2), Br (entry 3), NO₂ (entry 4), CN (entry 5), methoxy (entries 7–9), ester (entries 9, 10) and methylenedioxy (entry 11). Futhermore, aliphatic, aromatic and heterocyclic aldehydes are reduced to correponding alcohols under these mild reaction conditions. It is worth commenting that aldehyde group was selectively reduced in the presence of ketone group (entry 15). Thus tolerance of different reducible groups to these reaction conditions depicts the flexibility and generality of the protocol.

In conclusion, the present results demonstrate the novelty of SBER which shows unique selectivity and constitutes a useful alternative to the commonly accepted reduction procedures. Moreover, the superiority and flexibility of the protocol lies in the ease of isolation of products by simple filtration of the reagent that can be reactivated and reused without appreciable loss of activity.

EXPERIMENTAL

All solvents were distilled before use. All chemicals were of analytical grade.

General procedure for reduction of aldehydes with SBER: Sulfur powder (2 mmol) and borohydride exchange resin (prepared using reported method, ^{1c} 2 g) was added in methanol (10 mL) and stirred until colour of resin becomes red (15–20 min), ensuring that BER changed to sulfurated borohydride exchange resin (SBER). Then aldehyde (2 mmol) was added to SBER and stirred at 25° C for specified time (table). A spontaneous reaction took place which was observed by change in colour of the resin from red to faint yellow. After completion of reaction (TLC) the resin was removed by filtration and washed with methanol (2 × 5 mL) and the combined filtrate was concentrated under reduced pressure to yield alcohols.



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SULFURATED BOROHYDRIDE EXCHANGE RESIN

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Sr No.	Reactant	Product	Time (min)	Yield ^{a,b} %
1	F-∕◯∕-СНО	ғ-⊘-сң он	5	93
2	сі-(О)-сно	сі-{()-сңон	4	90
3	Br-O-CHO	Br-O-CH2OH	4	86
4	O ₂ N-(O)-CHO	О₂№-⟨◯⟩-СҢ₂ОН	4	85
5	NC-O-CHO	NC-O-CH2OH	7	86
6	но-О-сно	ноО-сңон	15	82
7	MeO MeO MeO	MeO MeO MeO	45	92
8	МеО НО-ОО-СНО	мео но-О-сн _г он	35	80
9	ме0, Сн,соо-⟨◯⟩-Сно	мео, Сң.соо-⊘-сң.он	15	91
10	С°н°соо-∕⊙∕-сно	С°н²соо-∕⊘-сн⁵он	15	80
11	0-{⊙-сно	о-О-СҢон	10	90
12	(Me ₂)N-O-CHO	(Me ₂)N-{O}-CH ₂ OH	45	91
13	CHO	С _S сңон	10	90
14	CH ₃ (CH ₂) ₄ CHO	СӉ(СӉ),СӉОН	10	82
15	СӉ _с со но-О-сно	СӉ ₄ СО НО-ОО-СӉ ₂ ОН	15	90

Table. Rapid and Selective Reduction of Aldehydes Using SBER

a. Yields are of isolated products b.products are characterised by their physical constants, IR, ¹H NMR, elemental analysis and comparison with authentic samples.

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