催化学报 » 2012, Vol. 33 » Issue (10) :1636-1641 DOI: 10.1016/S1872-2067(11)60414-2

研究论文

$Yb(OTf)_3$ 催化的碳氢键活化 2-甲基氮杂芳烃对靛红的加成反应

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摘要 发展了 $Yb(OTf)_3$ 催化的碳氢键活化 2-甲基氮杂芳烃或 4-甲基氮杂芳烃对靛红的加成反应, 对不同靛红和氮杂芳烃都取得了较好的产率. 该方法能够一步快速合成具有重要生理活性的氮杂芳烃取代的 3-羟基-2-氧化吲哚类化合物, 同时该反应成功扩展了路易斯酸在 sp3 碳氢键活化中的应用.

关键词: 三氟甲磺酸镱 路易斯酸 加成反应 3-羟基-2-氧化吲哚 2-甲基氮杂芳烃

Abstract: 3-Substituted-3-hydroxy-2-oxindoles are rich in a range of biologically active natural products and pharmaceuticals and development of efficient methods to construct this key motif is of vital importance. $Yb(OTf)_3$-catalyzed addition of 2- or 4-methyl azaarenes to isatins via C–H functionalization was developed. Moderate to good yields were obtained for various isatins and azaarenes. This method provides rapid protocol for the synthesis of biologically important azaarene-substituted 3-hydroxy-2-oxindoles in one step. The success of this reaction expands the synthetic utility of Lewis acid in the catalytic functionalization of sp^3 C–H bonds in organic synthesis.

Keywords: ytterbium triflate, Lewis acid, addition, 3-hydroxy-2-oxindole, 2-methylazaarene

收稿日期: 2012-05-15; 出版日期: 2012-07-27

引用本文:
牛瑞, 杨世迎, 肖建等 .$Yb(OTf)_3$ 催化的碳氢键活化 2-甲基氮杂芳烃对靛红的加成反应[J] 催化学报, 2012,V33(10): 1636-1641

NIU Rui, YANG Shi-Ying, XIAO Jian etc .$Yb(OTf)_3$-Catalyzed Addition of 2-Methyl Azaarenes to Isatins via C–H Functionalization[J] Chinese Journal of Catalysis, 2012,V33(10): 1636-1641

链接本文:
http://www.chxb.cn/CN/10.1016/S1872-2067(11)60414-2 或 http://www.chxb.cn/CN/Y2012/V33/I10/1636

[1] Tobisu M, Chatani N. Angew Chem, Int Ed, 2006, 45: 1683

[2] Campos K R. Chem Soc Rev, 2007, 36: 1069

[3] Jazzar R, Hitce J, Renaudat A, Sofack-Kreutzer J, Baudoin O. Chem Eur J, 2010, 16: 2654

[4] Ramirez T A, Zhao B, Shi Y. Chem Soc Rev, 2012, 41: 931

[5] Campeau L-C, Bertrand-Laperle M, Leclerc J-P, Villemure E, Gorelsky S, Fagnou K. J Am Chem Soc, 2008, 130: 3276

[6] Campeau L-C, Shipper D J, Fagnou K. J Am Chem Soc, 2008, 130: 3266

[7] Kanyiva K S, Nakao Y, Hiyama T. Angew Chem, Int Ed, 2007, 46: 8872

[8] Cho S H, Hwang S J, Chang S. J Am Chem Soc, 2008, 130: 9254

[9] Larivée A, Mousseau J J, Charette A B. J Am Chem Soc, 2008, 130: 52

[10] Mousseau J J, Bull J A, Charette A B. Angew Chem, Int Ed, 2010, 49: 1115

[11] Tobisu M, Hyodo I, Chatani N. J Am Chem Soc, 2009, 131: 12070

[12] Nakao Y, Kanyiva K S, Hiyama T. J Am Chem Soc, 2008, 130: 2448

[13] Deng G, Li C-J. Org Lett, 2009, 11: 1171

[14] Qian B, Guo S, Shao J, Zhu Q, Yang L, Xia C, Huang H. J Am Chem Soc, 2010, 132: 3650

[15] Qian B, Guo S, Xia C, Huang H. Adv Synth Catal, 2010, 352: 3195

[16] Rueping M, Tolstoluzhsky N. Org Lett, 2011, 13: 1095

[17] Shaikh R R, Mazzanti A, Petrini M, Bartoli G, Melchiorre P. Angew Chem, Int Ed, 2008, 47: 8707

[18] Komai H, Yoshino T, Matsunaga S, Kanai M. Org Lett, 2011, 13: 1706

[19] Qian B, Xie P, Xie Y, Huang H. Org Lett, 2011, 13: 2580

[20] Yan Y, Xu K, Fang Y, Wang Z. J Org Chem, 2011, 76: 6849

[21] Sanchez-Sancho F, Herradon B. Heterocycles, 2003, 60: 1843

[22] Borne R F, Aboul-Enein H Y. J Heterocycl Chem, 1972, 933

[23] DeLorbe J E, Lotz M D, Martin S F. Org Lett, 2010, 12: 1576

[24] Taber D F, Guo P, Pirnot M T. J Org Chem, 2010, 75: 5737

[25] Peddibhotla S. Curr Bioact Compd, 2009, 5: 20

[26] Galliford C V, Scheidt K A. Angew Chem, Int Ed, 2007, 46: 8748

[27] Marti C, Carreira E M. Eur J Org Chem, 2003, 2209

[28] Zhou F, Liu Y L, Zhou J. Adv Synth Catal, 2010, 352: 1381

[29] Niu R, Xiao J, Liang T, Li X. Org Lett, 2012, 14: 676

[30] Pieper U, Stalke D. Organometallics, 1993, 12: 1201

[31] Leung W-P, Lee H K, Weng L-H, Luo B S, Zhou Z-Y, Mak T C W. Organometallics, 1996, 15: 1785

[32] Andrews P C, Armstrong D R, Raston C L, Roberts B A, Skelton B W, White A H. J Chem Soc, Dalton Trans, 2001: 996

[33] Thomas D, Baumann W, Spannenberg A, Kempe R, Rosenthal U. Organometallics, 1998, 17: 2096

[34] Niwa T, Yorimitsu H, Oshima K. Angew Chem, Int Ed, 2007, 46: 2643

[35] Shang R, Yang Z-W, Wang Y, Zhang S-L, Liu L. J Am Chem Soc, 2010, 132: 14391

[36] Song G Y, Su Y, Gong X, Han K L, Li X W. Org Lett, 2011, 13: 1968

[37] Wei X H, Zhao M, Du Z Y, Li X. Org Lett, 2011, 13: 4636

[38] Gong X, Song G Y, Zhang H, Li X. Org Lett, 2011, 13: 1766

[1] Naeimi HOSSEI;Namdari ROOZBEH.非均相温和条件下AICI3/H2SO4高效催化一锅法合成蒽醌衍生物[J]. 催化学报, 2008,29(1): 86-90

[2] 温广明;王文寿;陈黎行;郭洪臣;王祥生.ZnO/θ-AI2O3催化剂上全馏分FCC汽油的选择性加氢脱硫[J]. 催化学报, 2007,28(9): 823-828

[3] 彭家建;邓友全.室温离子液体催化合成碳酸丙烯酯[J]. 催化学报, 2001,22(6): 598-600