Convenient Synthesis of Cyclopropylalkanol Derivatives Possessing a Difluoromethylenephosphonate Group at the Ring

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Supporting Information

Procedure for Preparation of Ethyl (*E*)-3-Iodo-2-methylpropenoinate (*E*)-13.
To a solution of (*E*)-3-iodo-2-methyl-2-propen-1-ol[1] (4.66 g, 23.53 mmol) in CH_2Cl_2 (190 mL) at 0 °C were added Celite (10.5 g) and PCC (9.84 g, 45.7 mmol). The mixture was stirred at 0 °C for 4 h. The resulting suspension was filtered. The filtrate was washed with aqueous $NaHCO_3$ and brine, dried ($MgSO_4$), and concentrated to afford crude (*E*)-3-iodo-2-methylpropanal. This compound was not characteraized due to its rapid decomposition. To a mixture of crude (*E*)-3-iodo-2-methylpropanal in CH_3CN (29 mL), $NaH_2PO_4 \cdot H_2O$ (974 mg) in H_2O (19 mL), and H_2O_2 (30%, 33 mL, 284.7 mmol) at 0 °C was added dropwise a solution of $NaClO_2$ (80%, 3.78 g, 33.4 mmol) in H_2O (38 mL). The reaction mixture was stirred at the same temperature for 1 h and extracted with ether. The aqueous layer was acidified with 1N HCl and extracted with ether. The extracts were dried ($MgSO_4$) and evaporated to give crude (*E*)-3-iodo-2-methylpropeonic acid. This compoud was used for the next reaction without purification. A solution of crude (*E*)-3-iodo-2-methylpropeonic acid in EtOH (15 mL) containing 0.5 mL of c H_2SO_4 was heated under reflux for 2 h. After removing EtOH *in vacuo*, the residue was basified with aqueous $NaHCO_3$. The aqueous layer was extracted with $CHCl_3$. The extracts were washed with brine, dried ($MgSO_4$), and concentrated to give the residue. Purification by column chromatography on silica gel (*n*-hexane : EtOAc = 100 : 1) gave (*E*)-**13**

(2.31 g, 40.9% for 3 steps) as an oil. ^{1}H NMR ($CDCl_3$, 400 MHz) δ 6.74 (1H, s), 3.68 (2H q, J = 7.1 Hz), 1.53 (3H, s), 0.78 (3H, t, J = 7.1 Hz); ^{13}C NMR ($CDCl_3$, 100 MHz) δ 163.7, 139.7, 98.3, 61.2, 20.2, 14.1; IR (neat) 1713 cm^{-1}; EIMS m/z 240 (M^+). High resoultion MS *m/z* calcd for 239.9647 (M^+). Observed: 239.9660.

Reference

(1) a) Liu, F.; Negishi, E. *J. Org. Chem.* **1997**, 62, 8591. b) Negishi, E.; Van Horn, D. E.; King, A. O.; Okukado, N. *Synthesis* **1979**, 501.