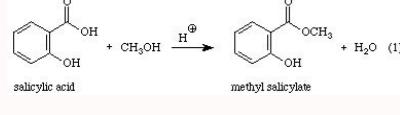
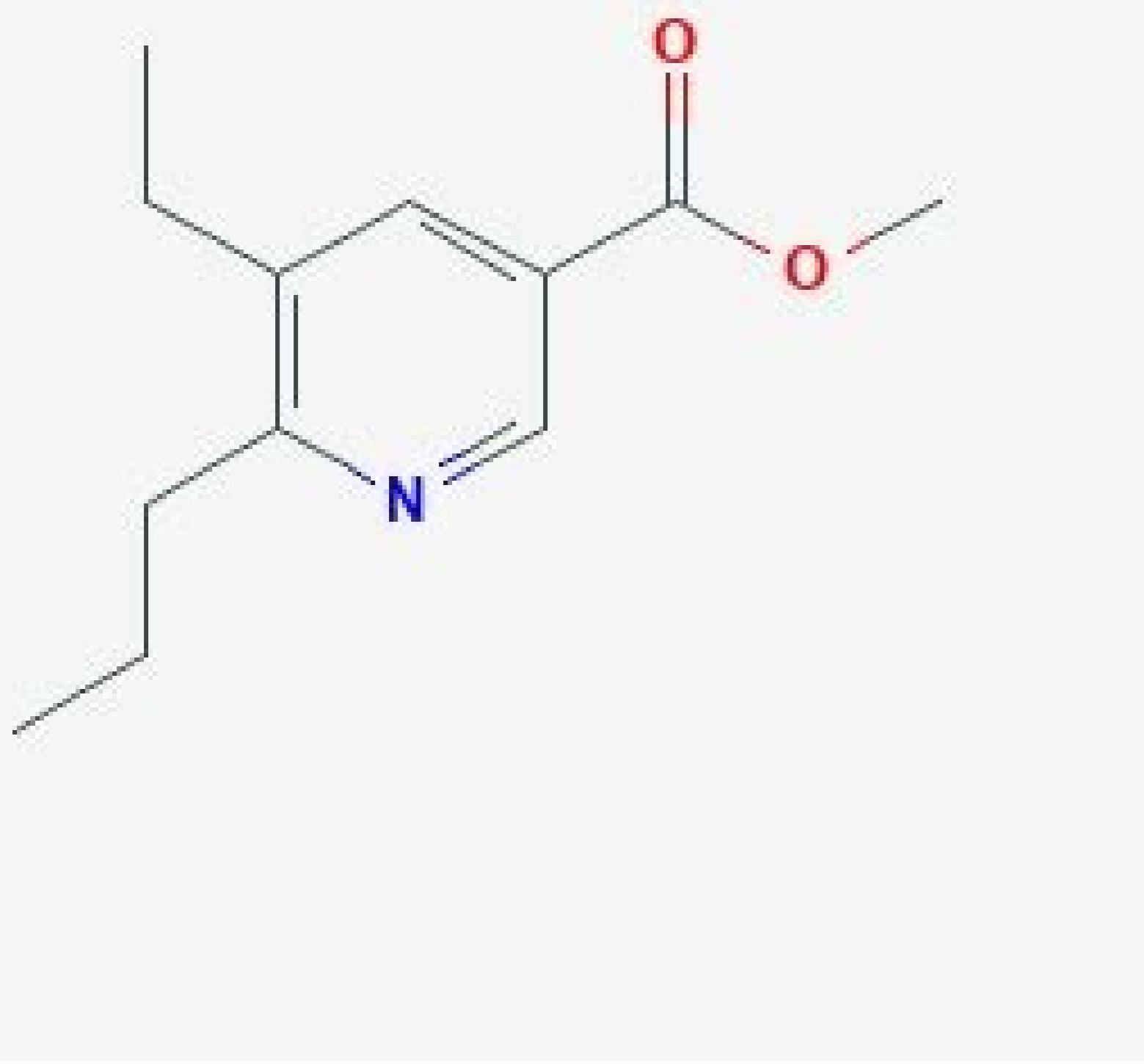


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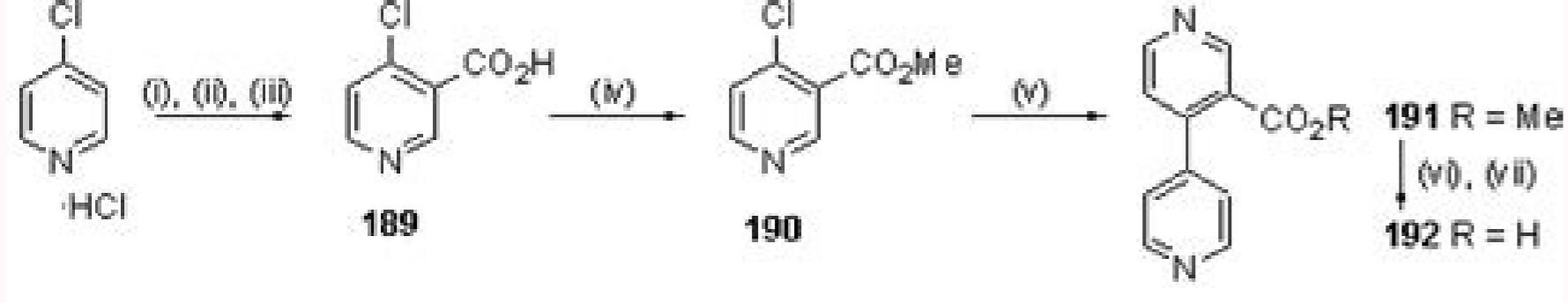
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## **Formation of methyl ester from carboxylic acid**



**Table** Names and structures of some esters

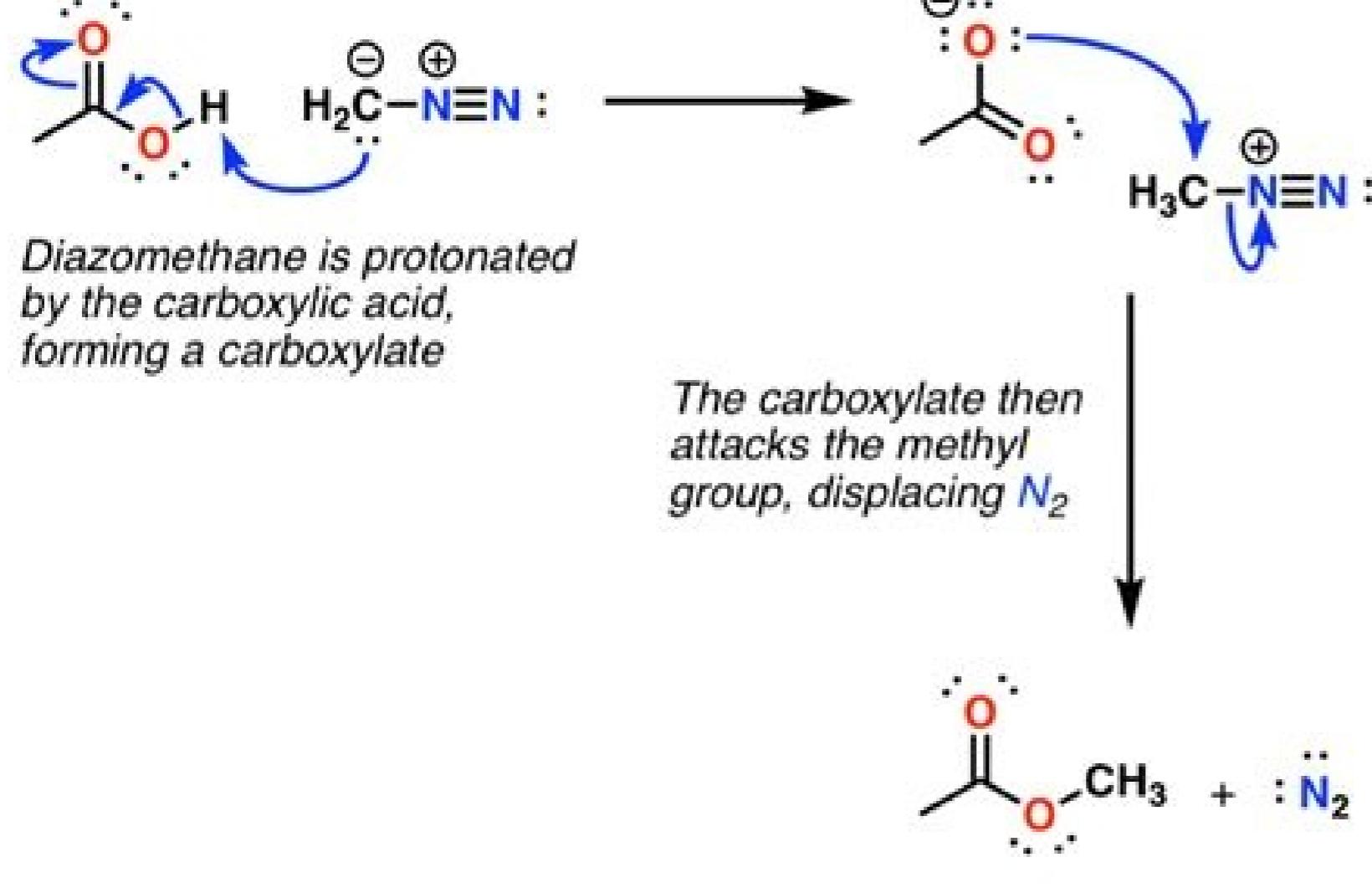
Carboxylic acid used	Alcohol used	Ester formed				
		Molecular formula		Structural formula		
HCOOH Methanoic acid	C <sub>2</sub> H <sub>5</sub> OH Ethanol	HCOOC <sub>2</sub> H <sub>5</sub> Ethyl methanoate		$\begin{array}{c} \text{O} & \text{H} & \text{H} \\   &   &   \\ \text{H} - \text{C} - \text{O} - \text{C} - \text{C} - \text{H} \\   &   \\ \text{H} & \text{H} \end{array}$		
CH <sub>3</sub> COOH Ethanoic acid	CH <sub>3</sub> OH Methanol	CH <sub>3</sub> COOCH <sub>3</sub> Methyl ethanoate		$\begin{array}{c} \text{H} & \text{O} & \text{H} \\   &   &   \\ \text{H} - \text{C} - \text{C} - \text{O} - \text{C} - \text{H} \\   &   \\ \text{H} & \text{H} \end{array}$		
C <sub>2</sub> H <sub>5</sub> COOH Propanoic acid	C <sub>2</sub> H <sub>5</sub> OH Ethanol	C <sub>2</sub> H <sub>5</sub> COOC <sub>2</sub> H <sub>5</sub> Ethyl propanoate		$\begin{array}{c} \text{H} & \text{H} & \text{O} & \text{H} & \text{H} \\   &   &   &   &   \\ \text{H} - \text{C} - \text{C} - \text{C} - \text{O} - \text{C} - \text{C} - \text{H} \\   &   &   &   &   \\ \text{H} & \text{H} & \text{H} & \text{H} & \text{H} \end{array}$		
C <sub>3</sub> H <sub>7</sub> COOH Butanoic acid	C <sub>3</sub> H <sub>7</sub> OH Propan-1-ol	C <sub>3</sub> H <sub>7</sub> COOC <sub>3</sub> H <sub>7</sub> Propyl butanoate		$\begin{array}{c} \text{H} & \text{H} & \text{H} & \text{O} & \text{H} & \text{H} & \text{H} \\   &   &   &   &   &   &   \\ \text{H} - \text{C} - \text{C} - \text{C} - \text{C} - \text{O} - \text{C} - \text{C} - \text{C} - \text{H} \\   &   &   &   &   &   &   \\ \text{H} & \text{H} & \text{H} & \text{H} & \text{H} & \text{H} & \text{H} \end{array}$		



### Scheme 3.11

Synthesis of 4,4'-bipyridine-3-carboxylic acid. Reagents and conditions. (i)  $\text{Na}_2\text{CO}_3$  (aq); (ii) LDA, THF,  $-75^\circ\text{C}$ ; (iii)  $\text{CO}_2$ ; (iv) DCC, MeOH, DMAP, DMF, rt; (v)  $\text{Pd}(\text{PPh}_3)_4$ , LiCl, 4-pyridyl trimethyl stannane, toluene,  $110^\circ\text{C}$ ; (vi) NaOH (aq), reflux, 2.5 h; (vii) HCl (aq).

## How it works: Formation of methyl esters



Which of the following reactions involves the formation of a methyl ester from a carboxylic acid?

2008, XI, 295 Å ¢ 306 .ã, [Google Scholar] D'Souza, J. Increase the temperature of 130 to 190 Å ° C can improve transform from 4 to 89% in Table 1. The bromine substitute (1K) is greater transformation and yield (10%) than the chlorine substitute (1J) due to its lower electronegativity. Jacobson, N.; Schmidt, S. Schneider, Synlett, 2007, 491-493. Comb. Other Substances of Metallic Steres An easy access system consisting of PD / vegetable coat in combination with bismuth nitrate (III) and metal telúrio allows an efficient oxidative methyl stereification Aerobics of primary alcohols, displays a broad substrate scope and is effective with activated and non-activated alkoles, containing several functional groups. US Patent 6 515 167, 2003.ã, [Google Scholar] Shieh, W.-C. Chem., 2015, 80, 7305-7310. We present an environmentally benign method to synthesize it is common metal steres using DMC under K2co3Å3 Å ¢ tbacl Catboard. The conversion for most carboxylic acids obtained in good yield with very high selectivity for the corresponding metallic steres. 1992, 57, 2166 Å ¢ 2169. (Crossref), [Web of Science ãoâ®], ã, [Google Scholar] Ballini, R.; Grenouillat, D. The good conversion is obtained in cases of 1B, 1H, and 1I who have substitutes donated by Elém Thrones to Methyl or methoxy. This inverse Micella type is successfully applied in the various hydrolysis is stereless without the decomposition of sensitive moieties to the base and without any loss of Ótica purity for the carboxylic acids ± -Heterosubstituted. John Wiley & Sons, , 7, 1041 Å ¢ â¬ "1045. [Crossref], [Google Academic] Jungle, M. 2010, 12, 3645 - 3647. [Crossref], [PubMed], [Web of Science ¢], [Google Academic] Ind. A. A. GC Analyzes were performed on the Agilent GC System 6890 series, equipped with a selective 5973 agilent mass detector and a DB-5ms capillary column (60 mÅ³-0.25 mmÅ£-0.3 ¼m). Synthesis 1986, 5, 382 Å ¢ â¬ "383. [Crossref], [google erudite] Lee, Y. ³ labeling studies suggest a mechanism via the direct transfer of methyl from dimethylcarbonate to the substrate. Selva and Tundo explored the DMC region with mercaptobenz³icos and carboxy acids with the substituents of the presence of a cheap nontoxic catalyst K2CO3 22.; Sun, Y.; Carotti, A.; Saidi, m.r. synth. Tetrahedron Lett. : New Jersey, 2007; 553 Å¢ â¬ "573. [Google Cliff] Furniss, B.S. ; Hannaford, A.J. ; Smith, p.w.g. ; Tatchell, A. This tendency has been observed more evidently in 1L in which the nitro group positioned ortho reduces the density of el ¢trons in the carboxyl group via resonance, as well as inductive effect of withdrawal of el ¢trons. Chem., 2013, 78, 11606-11611. M. Conversion can be promoted by organic bases, such as 4-dimethylaminopyridine 23, 1,8-diazabicyclo [5.4.0] UNDEC-7-ENE 2426, 1,4-diazabicyclo [2.2.2]-CTANE 24, and 1,2-dimethylimidazole 27.; Imon, S.; Senet, j.-p. ; Thiebaud, S. NMR spectra 1H were recorded in Varian Mercury 300 MHz using CDCl3 and Tetramethylsilane (TMS) as solvent and internal standard, respectively. No significant change in conversion is also observed when moving the carboxyl group away from the benzene ring (1D and 1E). ; Hill, k. org. STAHL, org. ; Wei, W. Pattarawarapan, Synlett, 2015, 26, 2006-2008. Lu, D. Then, it was connected to a condenser and placed in a ³ bath that was heated to 170 Å ° C. The efficiency of the conversion therefore depends on the negative charge density in the corresponding carboxylates µ. ; Å ¢ Å 292 , 41 , 7002 .F, rebeiS ]ralohcS elgooG[ ,]®Å ecneicS fo beW[ ,]ferssorC[ Å . 3889 Å ¢ Å 5789 , 65 , 0002 nordeharteT .T.T, atsopA ; .D.M , swaLcM ; .E.G ,kceK ]ralohcS elgooG[ Å ,]ferssorC[ Å . 97 Å ¢ Å 37 , 01 , 8002 .H, uhZ .evalcotua ed aicn¤Ägixe, edadiviteles axiab :saicn¤Äcifed sair;Äv ;Äh ,ofÄsrevnoc atla ad rasepA .B , nnamueN ; .Q ,uX .Y ,adaW ; .R .sotnemidner sotla me sotartsbus soir;Äv ed ritrap a sodaraperp marof olila e oliporposi ,olite, olitem ed seretsÅ .1624-4524 ,68 ,1202 ,.mehC .83 C°ÄÅ021 ed amica erroco ofÄ§Äalitem a otnauqne ,C°ÄÅ09 sanepa ed ©Ä CMD od ofÄ§Äilube ed otnop o[ rerroco edop ofÄ§Äalitem a euq me arutarepmet a ajnita ofÄn ofÄ§Äaer ed arutsim a euq moc zaf avissecxe edaditnauq amu moc etnevlos omoc CMD od ofÄ§Äazilitu a ,otife moC .N , iakaS ; .lanoicida ofÄ§Äacifirup reuqlauq mes sodazilitu e hcirdlA-amgiS Å sodiriuqda marof socimÄuq sotudorp so sodoT .23 osoroposem otacilissonsimula e 13 03 otil³Äez ,92 asoroposem adataflus ain 'Äcriz ,sejÄina moc sodacifidom 82 soci;Ätem sodix³Ä :sodic;Ä sodil³Äs serodasilatac snugla sodazilitu m©Ämat maroF .ofÄ§Äagitsevni atse a oriecnanif oiopa o )ADINAD( lanoicanretni otnemivlovesed ed aseuqramanid aicn¤Äga Å somecedargA .R , adekI ; .B.Y , nariK ]ralohcS elgooG[ Å ,]®Å ecneicS fo beW[ ,]ferssorC[ Å . 10721 Å ¢ Å 59621 , 36 , 7002 ordearteT .sociÄxobrac sodic;Ä ralitem arap odasu ©Ä euq zev ariemirp a ©Ä atse sam ,71 CMD moc si³Änef ed ofÄ§Äalitem a arap odacilpa iof ocitÄlatac ametsis etsE .)lomm 9,0 ,gm 502( ICABT e )lomm 3,0 ,gm 14( 3OC2K ,)lomm 0,6 ,gm 045(CMD ,)lomm 0,3 ,gm 663( ociozneb odic;Ä moc oiehc iof )emulov ed lm 01( A .S ocsarf mU .snarT nikreP ,.coS .L ,naY .S , anayarsnaytaS ; .V.G ujarabbuS ; .C.-P ,gnaW ; .M.J , agneR ]ralohcS elgooG[ Å ,]®Å ecneicS fo beW[ ,]ferssorC[ Å . 7131 Å ¢ Å 9031 , 26 , 6002 nordeharteT .H Devulapelli, v.g. ; Weng, H.-S. ; Dell, S.J. Low temperature process to prepare is metal steres. ; TDODO, P. Under the basic activity of the K2CO3, the carboxylic acid changes to the carboxylate anion that interacts to one of the metallic groups of the DMC molene. 1988, 27, 1565 à, â € 1571. [Crossref], [Web of Science ¢], [Google Academic] Barcelo, G. BI additives and significantly increase the reaction rate, Selectivity and general product yields. 2002, 43, 5607 - 5609. [Crossref], [PUBMED], [Web of Science ¢], [Google Academic] Rajabi, F. 1999, 64, 8014 - 8017. [Crossref], [Web of Science ¢], [Google Academic] Fieser, LF; Fieser, M. Borredon, EJ Luo, C.-C. In order to overcome the limitations above, the exploration Of alternative methylation reagents, such as methyl iodide 4, dimethyl sulfate 56, and diazomethane 7, was reported. Y.: NEW YORK, 1967; 1, 191 - 195. [Google Academic] Mohacsi , E. phakhodee, MJ A catalyzed copper-catalyzed methylation of carboxylic acids using dimethyl-sulfoxide (DMSO) as the methyl source exhibits a broad substrate scope and excellent tolerance to the functional group. . The cleavage of the Lactariras offers the acids at - -iodalquylcarboxylicos corresponds Neans. Temperature in the oil bath. ; Chary, K.v.r. ; Narayanan, S. Tetrahedron 1995, 51, 11573 - 11580. [Crossref], [Web of Science ¢], [Google Academic] Tondo, p.; LECOMTE, L.; Rupakal, v.; Kinoshita, M. Dimethylbonate (DMC) satisfies the above requirements and was already frequently used for several functional groups of organic methylate: Phenids 12 - 17, Álcoois 18 19, Amines 20 Å ¢ Å ¢ , â¬ "33 à " 33 and activated methylen 34 - 37.; Trotta, F. Fisher's traditional sterification in which carboxylic acids are directly condensed - methanol under the acidic catboard, however, is undesirable due to its reversibility and harmful effects to the environment 3.; ed odatluser omoc odavresbo ©Ä roirefni ofÄsrevnoc a ,olixobrac opurg od otrep siam odanoicisop ;Ätse ixotem etniutitsbus o euq me G1 e F1 arap ,otnatne oN .P ,odnuT ]ocim¤ÄdacA elgooG[ ,]ferssorC[ .8231 - 3231 ,1 ,4991 .W ,atiaJ .ippA .A ,irakihsok .T ,onihsok .T ,ocim¤ÄdacA elgooG[ ,]®Å ecneicS fo beW[ ,]ferssorC[ .936" â¬ "836 ,44 ,9791 .A ,asoreP ;.A ,kasaB ; .K.A ,itroburkahC ]ocim¤ÄdacA elgooG[ ,]çå ecneicS fo beW[ ,]enilno sicnarF & rolyat[ .1021" â¬ "836 ,44 ,9791 .)FMD ,adimamrofitemid( etnevlos-oc mu ed otisiuquer e ,)evalcotua amu me arutarepmet e ofÄsserpt atla( sarud ofÄ§Äaer ed sejÄ§ÄaidnoC ,).viuqe 1( serodasilatac ed omusnoc ednarg ,socix³Ät sociÄÅt socimÄuq sotudorp :siev;Ätiveni sejÄ§Äatimil samugla metsixe ,otnatne oN .CMD moc ofÄ§Äacifiretse an oir;Äidemretni omoc otieca rof otalixobrac ofÄina o es odacilpxe res edop ossI .J ,ARETO ;.V ,revorG ;.B ,oahZ .E .de "Ä5 ,acit;Ärp acin¤Ägro acimÄuq ed orvil ,atuboN ;.T ,otaS ]ocim¤ÄdacA elgooG[ .9701" â¬ "7701 ,9891 ,kroY avoN :.N ,ujaragaN ; .R.S ,ikkamuriK ]ocim¤ÄdacA elgooG[ ,]®Å ecneicS fo beW[ ,]ferssorC[ .7171 - 1171 ,01 ,9002 .F ,oaiX ;.T ,aruim ; .odasu ©Ä 3oc2k siam odnauq zuder e 3OC2K od .824-124 ,84 ,6102 ,esetnÄS ,ouG .eruP elppA .L ,illaV ;.S ,llewoP .J ,aretO .B .J ,ij .ofÄ§Äamrofsart rohlem ued ofÄn saroh 21 ed amica ofÄ§Äaer ed opmet od ofÄsnapxe a otnauqne ,ofÄ§Äamrofsart ;Äm Ä avel )61 adartne( odnaturcne ofÄ§Äaer ed opmet O .sodagitsevni sociÄtem serets©Ä sod airoiam a arap sodavresbo marof azerup e otnemidner otlA .C ,seuqraM ;.O ,¤ÄipeR ;.s ,lleD ;.c .w ,heihS ;1912" â¬ "8812 ,76 ,2002 .O ,¤ÄipeR ; .litemid ed otanobrac moc sociÄxobrac sodic;Ä ed ofÄ§Äacifiretse a revomorp arap adarolpxe iof oin 'Ämalitubartet esaf ed aicn¤Ärefsart ed rodasilatac o moc ofÄ§Äanibmoc me 3OC2K a lauq on edrev e lic;Äf ossecorp mU omuseR .E ,olletiliM ;.M ,avleS ]ocim¤ÄdacA elgooG[ ,]çå ecneicS fo beW[ ,]deMbuP[ ,]ferssorC[ .086" â¬ "776 ,66 ,1002 .M , the effect of electron donation µ µ resonant and the inductive withdrawal effect of electrons. ; Marques, CA ; Jungle , M. Indian J. ; The search for a new methyl reagent that is both highly economical and environmentally friendly is therefore very important. ; Nagaraju , N. Indeed, the phase transfer catalyst (PTC) TBACl nÃ s³ increases the interaction between K2CO3 and the organic compounds, as well as it functions as a reaction medium to maintain the reaction mixture at high temperature, so that the methyl with the DMC can occur. Martinez-MuÃ±oz, D. Yue, Y. Y.

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