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(54) Title: ONE STEP PROCESS FOR THE SYNTHESIS OF AZIDO ALCOHOLS FROM ALKENE

(57) Abstract: The present invention relates to one step room temperature process for the synthesis of azido alcohols from alkenes. More particularly, I_2 catalysed a regio and diastereo selective one step room temperature process for the synthesis of 1,2-azido alcohols from alkenes.

ONE STEP PROCESS FOR THE SYNTHESIS OF AZIDO ALCOHOLS FROM ALKENE

FIELD OF THE INVENTION:

[001]The present invention relates to one step room temperature process for the synthesis of 1,2-azido alcohols from alkenes. More particularly, I_2 catalysed a regio and diastereo selective one step room temperature process for the synthesis of 1,2-azido alcohols from alkenes.

BACKGROUND OF THE INVENTION:

[002] 1,2-Azido alcohols have been widely employed in organic synthesis for the regioselective preparation of 1,2-amino alcohols and highly oxygenated compounds such as carbohydrates and nucleosides. They are also useful intermediates for the preparation of several target compounds such as triazoles, triazole-fused dihydrooxazinones, 2-oxazolidinones, 1,4-oxazepines and 1,3-oxazines, oxazaborolidines, 1,3-oxazolidines, and in the chemistry of peptidomimetics and pseudopeptides. Selective olefin difunctionalization with an azido and an oxygen based group is an important transformation for organic synthesis because vicinal azido alcohol derivatives are widely present in synthetically valuable molecules.

[003] The osmium-based Sharpless aminohydroxylation continues to be a prevalent stereospecific method for olefin amino-oxygenation. This pioneering method has also inspired extensive efforts for the development of alternative approaches to improve upon a broader substrate scope and a better regioselectivity. Among these approaches, non-precious metal catalyzed processes emerge with increasing interests.

[004] Article titled "Stereoselective radical azido oxygenation of alkenes" by Bo Zhang and Armido Studer et al. published in Organic Letter, 2013, 15, pp 4548-4551 reports a readily prepared N_3-iodine(III) reagent acts as a clean N_3-radical precursor in a radical azido oxygenation of various alkenes in the presence of TEMPONa as a mild

organic reducing reagent. The C-radical generated after N_3-radical addition is efficiently trapped by in situ generated TEMPO.

[005] Article titled "I_2-catalyzed regioselective oxo- and hydroxy-acyloxylation of alkenes and enol ethers: a facile access to α-acyloxyketones, esters, and diol derivatives" by Rambabu N. Reddi et al. published in Organic Letter, 2014, 16 (21), pp 5674–5677 reports I2-catalyzed oxo-acyloxylation of alkenes and enol ethers with carboxylic acids providing for the high yield synthesis of α-acyloxyketones and esters is described. This unprecedented regioselective oxidative process employs TBHP and Et_3N in stoichiometric amounts under metal-free conditions in DMSO as solvent. Additionally, I2-catalysis allows the direct hydroxy-acyloxylation of alkenes with the sequential addition of $BH_3 \cdot SMe_2$ leading to monoprotected diol derivatives in excellent yields.

[006] Article titled "Efficient catalytic synthesis of optically pure 1,2-azido alcohols through enantioselective epoxide ring opening with HN_3" by Santosh Singh Thakur et al. published in Journal of Molecular Catalysis A: Chemical, 2006, 259(1–2), pp 116–120 reports chiral binuclear Co(salen) complexes bearing Lewis acid of group 13 metal chlorides show very high catalytic activity and enantioselectivity for the ring opening of epoxides using HN_3 as azide source. It provides a facile and practical synthetic route to a wide range of chiral nonracemic 1,2-azido alcohols and related compounds in one-pot synthesis with excellent selectivity (92.0–99.6% e.e.) under mild conditions. The presence of Lewis acid of group 13 shows a strong synergistic effect.

[007] Article titled "Chiral epoxides via borane reduction of 2-haloketones catalyzed by spiroborate ester: application to the synthesis of optically pure 1,2-hydroxy ethers and 1,2-azido alcohols" by Kun Huang et al. published in Journal of Organic Chemistry, 2011, 76 (6), pp 1883–1886 reports an enantioselective borane-mediated reduction of a variety of 2-haloketones with 10% spiroaminoborate ester 1 as catalyst is described. By a simple basic workup of 2-halohydrins, optically active epoxides are obtained in high yield and with excellent enantiopurity (up to 99% ee). Ring-opening

of oxiranes with phenoxides or sodium azide is investigated under different reaction conditions affording nonracemic 1,2-hydroxy ethers and 1,2-azido alcohols with excellent enantioselectivity (99% ee) and in good to high chemical yield.

[008] Article titled "Nucleophilic ring opening of 1,2-epoxides in aqueous medium" by David Amantini et al. published in ARKIVOC 2002(11) 293-311 reports Nucleophilic ring opening of 1,2-epoxides in aqueous medium in the presence and absence of metal salts is reviewed. Azidolysis, hydrolysis, iodolysis and thiolysis are the reactions mainly investigated. The pH of the reaction medium controls the reactivity and regioselectivity of the process. By working at suitable pH values, even salts such as $AlCl_3$, $SnCl_4$ and $TiCl_4$ are active catalysts.

[009] Despite these and other excellent discoveries, a direct organocatalytic route for the synthesis of 1,2 azidoalcohols from alkenes is still desirable. Further, it is desirable that the direct route of synthesis provides good selectivity towards regio and diastereo isomers of 1,2-azidoalcohols.

OBJECTIVE OF THE INVENTION:

[010] The main objective of the present invention is to provide one step room temperature process for the synthesis of 1,2-azido alcohols from alkenes with high regioselectivity as well as diastereoselectivity.

[011] Another objective of the present invention is to provide metal free process for the synthesis of 1,2-azido alcohols from alkenes.

[012] Still another objective of the present invention is to provide high yield process for the synthesis of 1,2-azido alcohols from alkenes.

SUMMARY OF THE INVENTION:

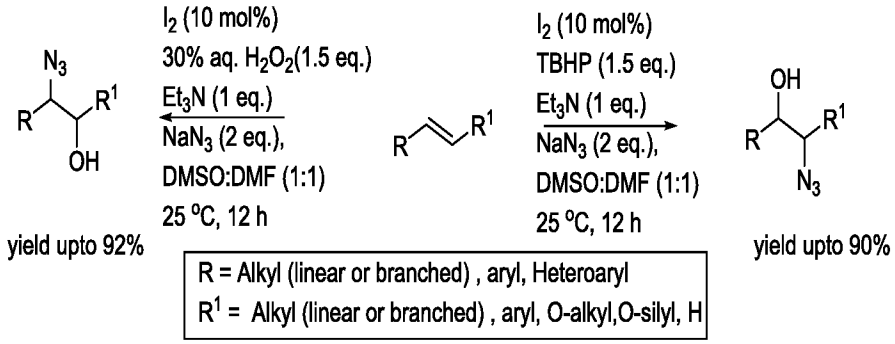
[013] Accordingly, the present invention provides one step room temperature process for the synthesis of 1,2-azido alcohol from alkenes including the steps: (a) adding halogen source to a stirred solution of alkene substrate in a solvent system followed by

addition of co-oxidant at 0°C to -5°C; (b) adding base to reaction mixture of step (a) followed by addition of azide source at a temperature ranging between 0°C to -5°C; (c) stirring the reaction mixture of step (b) at a temperature ranging between 25 to 30°C for 8-12 hours to afford 1,2-azidoalcohols .

[014] More particularly, the present invention provides I_2 catalysed a regio and diastereo selective one step room temperature process for the synthesis of 1,2-azido alcohol from alkenes.

[015] In an embodiment, I_2 catalysed a regio and diastereo selective one step room temperature process for the synthesis of azido alcohols from alkenes comprising treating alkenes with azide source in presence of base in a solvent system with the use of a co-oxidant to afford azido alcohol.

[016] The above process is shown in scheme 1 below:



Scheme 1

[017] In another embodiment, said azide source is sodium azide.

[018] Still another embodiment, said base may be selected from triethylamine (Et_3N), potassium carbonate (K_2CO_3), potassium tert-butoxide (K^tOBu), sodium hydride (NaH), 1,8-diazabicycloundec-7-ene (DBU).

[019] Yet another embodiment, said suitable solvents may be selected from water, acetonitrile, ethylacetate and C_1 to C_3 alcohols, dimethylsulfoxide (DMSO), dimethyl formamide (DMF), acetone, dioxane, tetrahydrofuran (THF), N,N-dimethylacetamide (DMA) or combinations thereof.

[020] Still yet another embodiment, said solvent system that works effectively for the process of invention comprises DMSO and DMF in a ratio of 1:1.

[021] Still yet another embodiment, said co-oxidant may be selected from anhydrous tert-butyl hydroperoxide (TBHP) or 30%-50% aq. H_2O_2.

[022] Still yet another embodiment, said alkenes may be selected from the group consisting of mono, di or tri substituted alkenes.

[023] Still yet another embodiment, Iodine source is selected from Iodine solution, tetra-n-butylammonium iodide, sodium iodide, potassium iodide.

[024] The present disclosure also relates to a process for preparation of chloramphenicol from 1,2-azidoalcohol comprising the steps of: (a) adding 20% palladium hydroxide on carbon to a stirred solution of azidoalcohol in methanol under H2 atmosphere at a temperature ranging between 25°C to afford aminodiol; (b) adding methyl dichloroacetate into aminodiol of step (a) and heating the solution at a temperature ranging between around 90°C for 1 hour to afford crude product; (c) adding crude product of step (b) into nitrating mixture at a temperature ranging between around -20°C; (d) stirring the solution of step c at a temperature of 0°C for 1 hour to afford chloramphenicol.

[025] Still yet another embodiment, said 1,2-azidoalcohol is Syn-2-azido-1-phenylpropane-1,3-diol.

[026] Still yet another embodiment, said nitrating mixture of step (c) is mixture of nitric acid and sulphuric acid.(conc. HNO_3: conc. H_2SO_4 (1:1)).

[027] The present discosure also relates to a process for preparation of tert-butyl anti-2,3-dihydroxy-1-(4-methoxyphenyl)propyl)carbamate from 1,2-azidoalchohol comprising the steps of: (a) adding 20% palladium hydroxide on carbon to a stirred solution of azidoalcohol in solvent under H2 atmosphere at a temperature ranging between 25°C for 12 hours to afford aminodiol; (b) adding Boc anhydride ((Boc)2O) and triethyl amine (Et3N) to a stirred solution of step (a) in dicholoromethane and allowing stirring at a temperature ranging from 25°C for 2 hours to afford tert-butyl anti-2,3-dihydroxy-1-(4-methoxyphenyl)propyl)carbamate.

[028] Still yet another embodiment, said 1,2-azidoalcohol is 3-azido-3-(4-methoxyphenyl)propane-1,2-diol.

[029] The present discosure also relates to a process for preparation of (4R,5R)-5-(hydroxymethyl)-4-(4-methoxyphenyl) oxazolidin-2-one from Terttert-butyl anti-2,3-dihydroxy-1-(4-methoxyphenyl)propyl)carbamate comprising adding sodium hydride to a solution of Terttert-butyl anti-2,3-dihydroxy-1-(4-methoxyphenyl)propyl)carbamate in dry THF under nitrogen temperature at a temperature ranging from 25°C to 30°C, stirring continued for 3-3.5 hours to afford (4R,5R)-5-(hydroxymethyl)-4-(4-methoxyphenyl) oxazolidin-2-one.

DETAILED DESCRIPTION OF THE INVENTION:

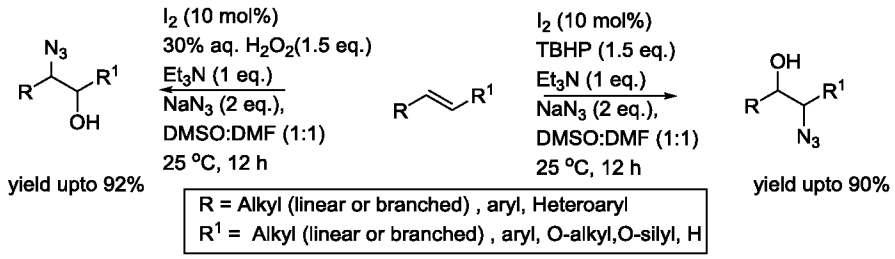
[030] The invention will now be described in detail in connection with certain preferred and optional embodiments, so that various aspects thereof may be more fully understood and appreciated.

[031] In view of above, the present invention provides one step room temperature process for the synthesis of 1,2-azido alcohol from alkenes.

[032] More particularly, the present invention provides I_2 catalysed a regio and diastereo selective one step room temperature process for the synthesis of 1,2-azido alcohol from alkenes.

[033] In an embodiment, I_2 catalysed a regio and diastereo selective one step room temperature process for the synthesis of 1,2-azido alcohol from alkenes comprising treating alkenes with azide source in presence of base in a solvent system with the use of a co-oxidant to afford 1,2-azido alcohol.

The above process is shown in scheme 1 below:



Scheme 1

[034] In another embodiment, said azide source is sodium azide.

[035] Still another embodiment, said base may be selected from triethylamine (Et_3N), potassium carbonate (K_2CO_3), potassium tert-butoxide(K^tOBu), sodium hydride (NaH), 1,8-diazabicycloundec-7-ene (DBU).

Yet another embodiment, said suitable solvents may be selected from water, acetonitrile, ethylacetate and C_1 to C_3 alcohols, dimethylsulfoxide (DMSO), dimethyl formamide (DMF), acetone, dioxane, tetrahydrofuran (THF), N,N-dimethylacetamide (DMA) or combinations thereof.

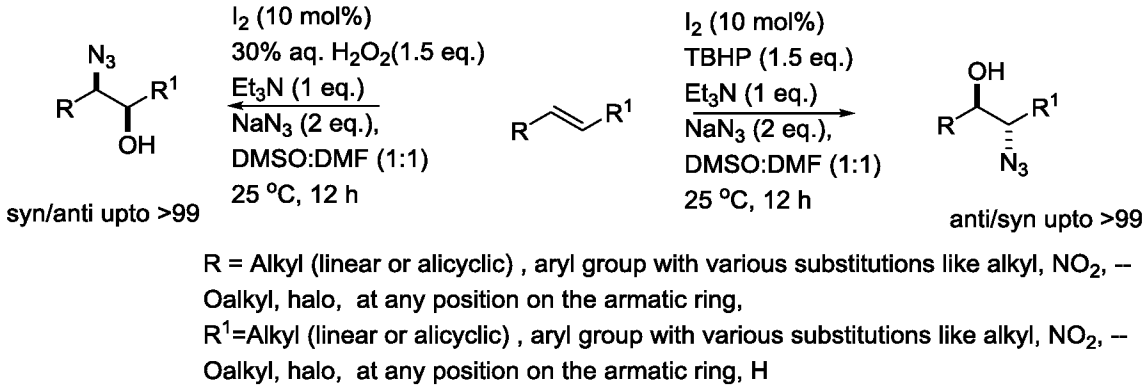
[036] Still yet another embodiment, said solvent system that works effectively for the process of invention comprises DMSO and DMF in a ratio of 1:1.

[037] Still yet another embodiment, said co-oxidant may be selected from anhydrous tert-butyl hydroperoxide (TBHP) or 30%-50% aq. H_2O_2 at ambient temperature. The ambient temperature for the purpose of the invention is 25°C to 35°C.

[038] Still yet another embodiment, said alkenes are selected from the group consisting of mono, di or tri substituted alkenes.

[039] Still yet another embodiment, Iodine source is selected from Iodine solution, tetra-n-butylammonium iodide, sodium iodide, potassium iodide.

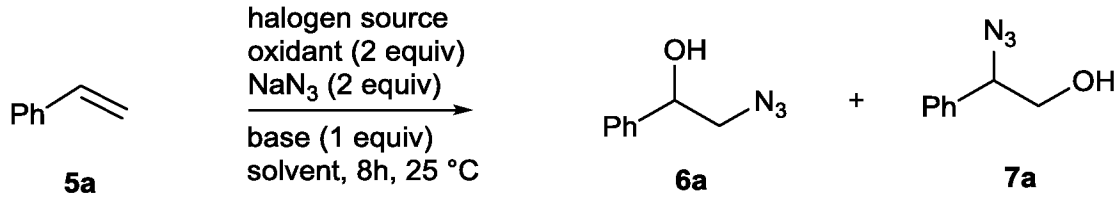
[040] In another embodiment, the scope of this reaction is further explored to include di and trisubstituted alkenes which resulted in an oxidant directed (TBHP/ aq. H_2O_2) highly diastereoselective reaction (**Scheme 2**).



Scheme 2

[041] Variously substituted aryl, heteroaryl and aliphatic substrates are found compatible with the reaction conditions employed in the instant method. The products were obtained in good to excellent yields and with high diastereoselectivity. The yield of the process is in the range of 70-95%.

[042] Following Scheme 3 shows I_2 catalyzed azidihydroxylation of styrene



Scheme 3

Following table 1 shows I_2-catalyzed regiodivergent azidohydroxylation of styrene: optimization studies

Table 1

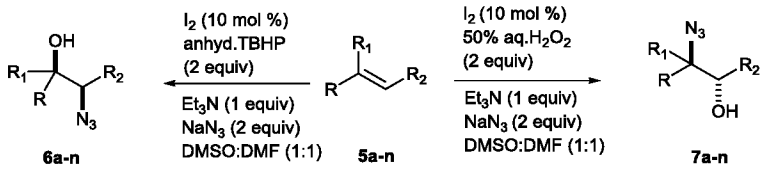
No.	Halogen Source (10 mol %)	Oxidant	Base	Solvent	Yield of **2a**
1	I_2	TBHP	Et_3N	DMF	53
2	I_2	TBHP	Et_3N	THF+DMF	10

3	I_2	TBHP	Et_3N	CH_3CN+DMF	48
4	I_2	TBHP	Et_3N	CH_2Cl_2+DMF	18
5	I_2	TBHP	Et_3N	DMSO+ DMF	90,38
6	I_2	TBHP	K_2CO_3	DMSO+ DMF	18
7	I_2	TBHP	K^{t}OBu	DMSO+ DMF	44
8	I_2	TBHP	NaH	DMSO+ DMF	32
9	I_2	TBHP	DBU	DMSO+ DMF	65
10	^{n}Bu$_4$NI	TBHP	Et_3N	DMSO+ DMF	5
11	NaI	TBHP	Et_3N	DMSO+ DMF	11
12	KI	TBHP	Et_3N	DMSO+ DMF	14
13	I_2	50% aq.H_2O_2	Et_3N	DMSO+ DMF	82
14	I_2	30 % aq.H_2O_2	Et_3N	DMSO+ DMF	78

The representative examples are shown in **Table 2** below. Reaction conditions are same as Scheme 1.

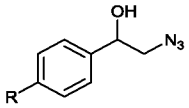
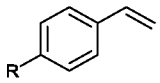
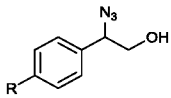
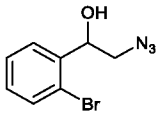
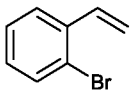
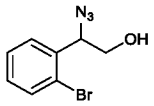
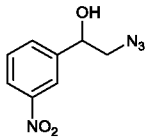
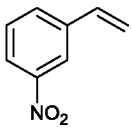
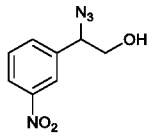
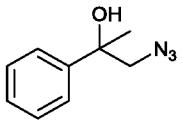
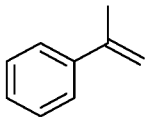
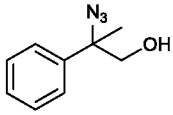
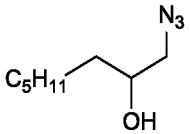
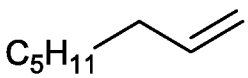
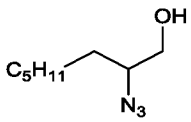
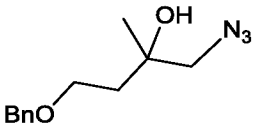
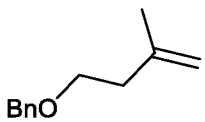
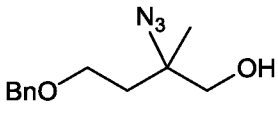
Table

Following scheme 4 shows I_2-catalyzed regio- and stereodivergent azidohydroxylation of alkenes



Scheme 4

Following table 2 shows some examples of using reaction condition of scheme 4.

Products (**6a–n**)	Substrates (**5a-n**)	Products (**7a–n**)
		
6a (90%) **6b** (88%) **6c** (76%)	**5a** R = H **5b** R = CH_3 **5c** R = OH	**7a** (82%) (12:1) **7b** (89%) (9:1) ---
		
6d 82%	**5d**	**7d** (86%) (10:1)
		
6e 77%	**5e**	**7e** (76%) (10:1)
		
6f (78%)	**5f**	**7f** (83%) (9:1)
		
6g (79%)	**5g**	**7g** (83%) (9:1)
		
6h (84%)	**5h**	**7h** (74%) (8:1)

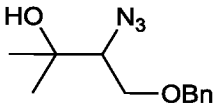
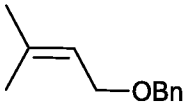
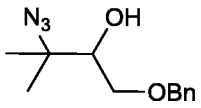
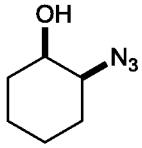
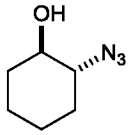
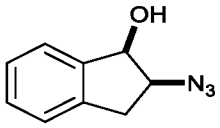
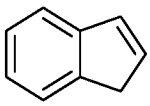
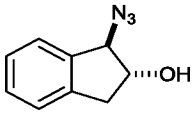
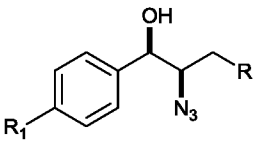
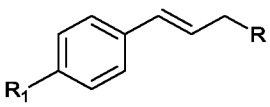
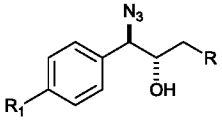
 **6i** (74%)	 **5i**	 **7i** (78%) (5:1)
 **6j** (87%) dr = 95:5	 **5j**	 **7j** (92%) dr = 95:5
 **6k**(87%) dr = 98:2	 **5k**	 **7k** (82%) dr = 92:8
 **6l** (88%) dr = 93:7 **6m** (80%) dr = 92:8 **6n** (82%) dr = 96:4	 **5l** R = H, R_1=H **5m** R= OH R_1=H **5n** R = OH, R_1=OMe	 **7l** (86%) dr = 97:3 **7m** (78%) dr = 94:6 **7n** (80%) dr = 98:2

Table 2

[043] Novel regio and diastereo 1,2-azidoalcohols are included 2-azido-1-(2-bromophenyl)ethan-1-ol, 1-azido-2-phenylpropan-2-ol, 1-azido-4-(benzyloxy)-2-methylbutan-2-ol, 3-azido-4-(benzyloxy)-2-methylbutan-2-ol, Syn-2-azido-1-phenylpropane-1,3-diol, 2-azido-1-(4-methoxyphenyl)propane-1,3-diol, 2-azido-2-phenylethan-1-ol, 2-azido-2-(p-tolyl)ethan-1-ol, 2-azido-2-(2-bromophenyl)ethan-1-ol, 2-azido-2-(3-nitrophenyl)ethan-1-ol, 2-azido-4-(benzyloxy)-2-methylbutan-1-ol, 3-azido-1-(benzyloxy)-3-methylbutan-2-ol, 3-azido-3-(4-methoxyphenyl)propane-1,2-diol

[044] The following examples, which include preferred embodiments, will serve to illustrate the practice of this invention, it being understood that the particulars shown are by way of example and for purpose of illustrative discussion of preferred embodiments of the invention.

[045] EXAMPLES:

Solvents were purified and dried by standard procedures before use; petroleum ether of boiling range 60–80 °C was used. Melting points are uncorrected and recorded on a Buchi B-542 instrument. ^{1}H NMR and ^{13}C NMR spectra were recorded on Brucker AC-200 spectrometer unless mentioned otherwise. Deuterated solvent $CDCl_3$+ CCl_4 (70:30) were used as internal standard and singlet at 96.1 ppm in ^{13}C NMR corresponds to carbon of CCl_4. Elemental analysis was carried out on a Carlo Erba CHNS-O analyzer. HRMS data were recorded on a Waters SYNAPT G2 High Definition Mass Spectrometry System. Purification was done using column chromatography (230-400 mesh). The compounds **5a-n** and TBHP (5-6 M solution in decane: <4% water) are commercially available and were procured from Sigma Aldrich (used as such without any further purification). The relative configuration of diastereomers was determined by comparison of their ^{1}HNMR spectra with literature data.

[046] Example 2:

General experimental procedure for the preparation of vicinal azido alcohols (6a-n)

To a stirred solution of alkene (1 mmol) in DMSO: DMF (4 mL: 4 mL) at 0 °C was added I_2 (10 mol %) followed by dropwise addition of 5- 6 M TBHP in decane (2 mmol, 0.360 mL). The addition of Et_3N (1 mmol, 0.140 mL) was then done slowly (slow decolorisation of reaction mixture was observed) and finally sodium azide (2 mmol, 130 mg) was added pinchwise. The reaction mixture was then allowed to stir at room temperature (25°C) for 8 hours (monitored by TLC). After completion, the reaction mixture was then cooled to 0 °C excess sodium azide was quenched with

water. Organic layer was diluted with EtOAc. The organic layer was separated and the aqueous layer was extracted with EtOAc (3 x 20 mL). The combined organic extracts were repeatedly washed with saturated brine solution, dried over anhyd. Na_2SO_4 and concentrated under reduced pressure to give crude products which were purified by column chromatography [silica gel (230-400 mesh)] using petroleum ether: EtOAc (8:2) as an eluent to afford corresponding vicinal azido alcohol (**6a-n**) in 74-90% yield.

Spectroscopic data of examples of 1,2- azido alcohols products:

The chemical structures are presented in Table 2.

1) 2-azido-1-phenylethan-1-ol (6a)

Yield: 90% (146 mg); Colorless viscous liquid; R_f = 0.40 (Pet ether: EtOAc = 8: 2); **IR** ($CHCl_3$, cm^{-1}) ν_{max} 1031, 1101, 1247, 2103, 2847, 2933, 3356; **^{1}H NMR** (400 MHz,$CDCl_3$): δ 2.61 (br. s, 1H), 3.41 (dd, *J* = 3.7, 12.4, 1H), 3.47 (dd, *J* = 8.2, 12.4, 1H,), 4.85 (dd, *J* = 8.2, 3.9 Hz, 1H), 7.30 - 7.39 (m, 5H); **^{13}C NMR** (50 MHz, $CDCl_3$) δ58.1, 73.4, 125.9, 128.3, 128.7, 140.6; **HRMS** calcd for [$(C_8H_9N_3O+Na)^+$] 186.0638; found: 186.0640.

2) 2-azido-1-(p-tolyl)ethan-1-ol (6b)

Yield: 88% (155 mg); Colorless gum; R_f = 0.40 (Pet ether: EtOAc = 8: 2); **IR** ($CHCl_3$, cm^{-1}) ν_{max} 750, 1222, 2095, 2950, 3020, 3412; **^{1}H NMR** (200 MHz,$CDCl_3$) δ 2.34 (s, 3H), 2.63 (br. s., 1H), 3.32 - 3.51 (m, 2H), 4.81 (dd, *J* = 7.6, 4.4 Hz, 1H), 7.17 (d, *J* = 8.1 Hz, 2H), 7.24 (d, *J* = 8.2 Hz, 2H); **^{13}C NMR** (50 MHz, $CDCl_3$) δ 21.1, 58.0, 73.2, 125.8, 129.3, 137.6, 138.1; **HRMS** calcd for [$(C_9H_{11}N_3O+Na)^+$] : 200.0794; found: 200.0793.

3) 4-(2-azido-1-hydroxyethyl)phenol (6c)

Yield: 76% (135 mg); Colorless liquid; R_f = 0.40 (Pet ether: EtOAc = 7: 3); **IR** ($CHCl_3$, cm^{-1}) ν_{max} 1247,1607, 2103, 2923, 3356; **^{1}H NMR** (200 MHz,$CDCl_3$) δ 3.41 - 3.46 (m, 2H), 4.32 - 4.36 (m, 1H), 4.81 (dd, *J* = 7.7, 4.5 Hz, 1H), 6.81 (d, 2H, *J* = 8.5

Hz), 7.24 (d, 2H, *J* = 8.4 Hz), 7.97 (s, D_2O exchangeable, 1H); **^{13}C NMR** (50 MHz,$CDCl_3$) δ 58.1, 73.1, 115.6, 127.5, 128.6, 155.8; **HRMS** calcd for [($C_8H_9N_3O_2$+Na)$^+$] 202.0587 found 202.0579.

4) 2-azido-1-(2-bromophenyl)ethan-1-ol (6d)

Yield: 82% (196 mg); Colorless liquid; R_f = 0.40 (Pet ether: EtOAc = 8: 2); **IR** ($CHCl_3$, cm^{-1}) ν_{max} 761, 1012, 1214, 2103, 2724, 3018; **^{1}H NMR** (500 MHz, $CDCl_3$) δ 2.46 (d, *J* = 3.4 Hz, 1H), 3.35 (dd, *J* = 12.6, 8.2 Hz, 1H), 3.60 (dd, *J* = 12.6, 2.9 Hz, 1H), 5.26 (dt, 3.0 Hz, 1H), 7.19 (t, *J* = 8.5 Hz, 1H), 7.38 (t, *J* = 8.5 Hz, 1H), 7.54 (d, *J* = 8.8 Hz, 1H), 7.64 (d, *J* = 9.1 Hz, 1H); **^{13}C NMR** (125 MHz,$CDCl_3$) δ 56.5, 72.4, 121.7, 127.8, 127.9, 129.7, 132.8, 139.5; **HRMS** calcd for [($C_8H_8BrN_3O$+Na)$^+$] 263.9743 found 263.9738.

5) 2-azido-1-(3-nitrophenyl)ethan-1-ol (6e)

Yield: 77% (160 mg): Colorless liquid; R_f = 0.40 (Pet ether: EtOAc = 8: 2); **IR** ($CHCl_3$, cm^{-1}) ν_{max} 1211, 1350, 1531, 2104, 3438; **^{1}H NMR** (200 MHz, $CDCl_3$) δ 2.59 (s, 1H), 3.52 - 3.56 (m, 2H), 5.01 (t, *J* = 5.9 Hz, 1H), 7.58 (t, *J* = 7.9 Hz, 1H), 7.75 (d, *J* = 7.8 Hz, 1H), 8.19 - 8.30 (m, 2H); **^{13}C NMR** (101 MHz, $CDCl_3$) δ 57.9, 72.3, 121.0, 123.2, 129.6, 132.0, 142.6, 148.4. **HRMS** calcd for [($C_8H_8N_4O_4$+H)$^+$] 209.0674 found 209.0673.

6) 1-azido-2-phenylpropan-2-ol (6f)

Yield: 78% (140 mg); Colorless gum; R_f = 0.40 (Pet ether: EtOAc = 8: 2); **IR** ($CHCl_3$, cm^{-1}) ν_{max} 761, 1272, 2096, 2828, 2950, 3020, 3422 ; **^{1}H NMR** (500 MHz, $CDCl_3$) δ 1.61 (s, 3H), 2.36 (s, 1H), 3.45 (d, *J* = 12.3 Hz, 1H), 3.61 (d, *J* = 12.3 Hz, 1H), 7.29 - 7.32 (m, 1H), 7.37 – 7.40 (m, 2H), 7.45 - 7.47 (m, 2H); **^{13}C NMR** (125 MHz, $CDCl_3$) δ 27.1, 62.2, 74.5, 124.8, 127.5, 128.5, 144.7; **HRMS** calcd for [($C_9H_{11}N_3O$ +Na)$^+$] 200.0794; found: 200.0794.

7) 1-azidooctan-2-ol (6g)

Yield: 79% (135 mg); Colorless liquid; R_f = 0.60 (Pet ether: EtOAc = 8: 2); **IR** ($CHCl_3$, cm^{-1}) ν_{max} 759, 1261, 2104, 2937, 3404 ; **^{1}H NMR** (200 MHz,$CDCl_3$) δ 0.82

(t, *J* = 6.2 Hz, 3H), 1.23 (br. s., 7H), 1.38 (br. s., 3H), 1.97 (br. s., 1H), 3.18 - 3.34 (m, 2H), 3.67 (br. s., 1H); **^{13}C NMR** (50 MHz,$CDCl_3$) δ 14.1, 22.6, 25.4, 29.2, 31.8, 34.3, 57.2, 70.8; **HRMS** calcd for [$(C_8H_{17}N_3O+Na)^+$] 194.1264; found:194.1263.

8) 1-azido-4-(benzyloxy)-2-methylbutan-2-ol (6h)

Yield: 84% (196 mg); Colorless liquid; R_f = 0.50 (Pet ether: EtOAc = 8: 2); **IR** ($CHCl_3$, cm^{-1}) ν_{max} 705, 1082, 1274, 1717, 2106, 2926, 2974, 3412; **^{1}H NMR** (400 MHz,$CDCl_3$) δ 1.35 (s, 3H), 1.82 – 1.99 (m, 2H), 2.59 (d, *J* = 4.9 Hz, 1H), 2.70 (d, *J* = 4.9 Hz, 1H), 3.53- 3.62 (m, 2H), 4.50 (s, 2H), 7.28 - 7.37 (m, 5H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ21.6, 36.6, 53.9, 55.4, 66.6, 73.0, 127.6, 128.4, 138.3; **HRMS** calcd for [$(C_{12}H_{17}N_3O_2+Na)^+$] 258.1213; found: 258.1209.

9) 3-azido-4-(benzyloxy)-2-methylbutan-2-ol (6i)

Yield: 74% (175 mg); Colorless liquid; R_f = 0.50 (Pet ether: EtOAc = 8: 2); **IR** ($CHCl_3$, cm^{-1}) ν_{max} 705, 765, 1082, 1274, 1377, 1612, 1717, 2106, 2926, 2974, 3412; **^{1}H NMR** (200 MHz,$CDCl_3$) δ 1.27 (s, 3H), 1.35 (s, 3H), 2.98 (t, *J* = 5.4 Hz, 1H), 3.51 - 3.69 (m, 2H), 4.49 - 4.67 (m, 2H), 7.30 - 7.36 (m, 5H); **^{13}C NMR** (50 MHz,$CDCl_3$) δ 18.9, 24.7, 57.5, 61.9, 68.8, 73.2, 127.8, 128.4, 137.9; **HRMS** calcd for [$(C_{12}H_{17}N_3O_2+Na)^+$] 258.1213; found: 258.1210.

10) *Syn*-2-azidocyclohexan-1-ol (6j)

Yield: 87% (122 mg); Colorless liquid; R_f = 0.40 (Pet ether: EtOAc = 9: 1); **IR** ($CHCl_3$, cm^{-1}) ν_{max} 760, 1259, 2102, 2937, 3403; **^{1}H NMR** (400 MHz,$CDCl_3$) δ 1.28 - 1.34 (m, 3H), 1.37 - 1.56 (m, 1H), 1.83 - 1.90 (m, 1H), 2.00 - 2.16 (m, 2H), 2.34 (d, *J* = 2.3 Hz, 1H), 2.45 - 2.51 (m, 1H), 3.66 (td, *J* = 9.8, 3.9 Hz, 1H), 4.05 (ddd, *J* = 12.4, 9.8, 4.4 Hz, 1H); **^{13}C NMR** (50 MHz, $CDCl_3$) δ 24.4, 28.0, 33.6, 38.6, 43.5, 76.0; **HRMS** calcd for [$(C_6H_{11}N_3O+Na)^+$] 164.0794; found: 164.0794.

11) *Syn*-2-azido-2,3-dihydro-1H-inden-1-ol (6k)

Yield: 87% (152 mg); Colorless liquid; R_f = 0.50 (Pet ether: EtOAc = 8: 2); **IR** ($CHCl_3$, cm^{-1}) ν_{max} 770, 1219, 2097, 2916, 3356; **^{1}H NMR** (500 MHz,$CDCl_3$) δ 2.39 (d, *J* = 5.2 Hz, 1H), 3.14 -3.22 (m, 2H), 4.35 (q, *J* = 5.2 Hz, 1H), 5.16 (s, 1H), 7.28 -

7.34 (m, 3H), 7.45 - 7.47 (m, 1H); **^{13}C NMR** (125 MHz, $CDCl_3$) δ 35.2, 65.7, 76.4, 124.7, 125.1, 127.6, 129.0, 139.0, 141.9; **HRMS** calcd for [$(C_9H_9N_3O+Na)^+$] 198.0638; found:198.0640.

12) *Syn*-2-azido-1-phenylpropan-1-ol (6l)

Yield: 88% (155 mg); Colorless gum; R_f = 0.40 (Pet ether: EtOAc = 8: 2); **IR** ($CHCl_3$, cm^{-1}) ν_{max} 771, 1229, 1605, 2101, 2926, 3013, 3346; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 1.58 (d, *J* = 6.1 Hz, 3H), 4.56 - 4.66 (m, 1H), 5.12 (d, *J* = 7.8 Hz, 1H), 7.31 - 7.45 (m, 5H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ 18.4, 80.6, 84.8, 126.0, 129.2, 129.8, 135.2; **HRMS** calcd for [$(C_9H_{11}N_3O+Na)^+$] 200.0794; found: 200.0788;

13) *Syn*-2-azido-1-phenylpropane-1,3-diol (6m)

Yield: 80% (115 mg); colorless gum; R_f = 0.30 (Pet ether: EtOAc = 6: 4); **IR** ($CHCl_3$, cm^{-1}) ν_{max} 761, 1219, 1605, 2105, 2893, 2933, 3013, 3416; **^{1}H NMR** (200 MHz, $CDCl_3$) δ 2.64 (br. s., 1H), 2.70 (br. s, 1H), 3.51 - 3.73 (m, 2H), 3.83 (d, *J* = 4.7 Hz, 1H), 4.85 (t, *J* = 6.5 Hz, 1H), 7.34-7.43 (m, 5 H); **^{13}C NMR** (125 MHz, $CDCl_3$) δ 62.8, 67.0, 74.0, 126.5, 127.8, 128.9, 136.2; **HRMS** calcd for [$(C_9H_{11}N_3O_2+Na)^+$] 216.0749 found: 216.0736.

14) 2-azido-1-(4-methoxyphenyl)propane-1,3-diol (6n)

Yield: 82% (182 mg); colorless gum: R_f = 0.30 (Pet ether: EtOAc = 6: 4); **IR** ($CHCl_3$, cm^{-1}) ν_{max} 754, 1222, 2103, 2822, 2937, 3397; **^{1}H NMR** (200 MHz, $CDCl_3$) δ3.51 - 3.90 (m, 6H), 4.78 (t, *J* = 5.56 Hz, 1H), 6.88- 6.95 (m, 2H), 7.29- 7.35 (m, 2H). **^{13}C NMR** (100 MHz,) $CDCl_3$ δ 55.3, 62.7, 69.1, 74.4, 114.1, 127.6, 132.2, 159.7; **HRMS** calcd for [$(C_{10}H_{13}N_3O_3+H)^+$] 224.1035 found: 224.1033.

[047] Example 3:

Experimental procedure for the preparation of *Syn*-2-azido-1-phenylpropane-1,3-diol (6m):

To a stirred solution of alkene (10 mmol, 1.34 g) in DMSO: DMF (40 mL: 40 mL) at 0 °C was added I_2 (10 mol %, 0.253 g) followed by dropwise addition of 5- 6 M TBHP in decane (20 mmol, 3.60 mL). The addition of Et_3N (10 mmol, 1.3 mL) was then done

slowly (slow decolorisation of reaction mixture was observed) and finally sodium azide (20 mmol, 1.28 g) was added pinchwise. The reaction mixture was then allowed to stir at room temperature (25°C) for 8 hours (monitored by TLC). After completion, the reaction mixture was then cooled to 0 °C and excess sodium azide was quenched with water. Organic layer was diluted with EtOAc. The organic layer was separated and the aqueous layer was extracted with EtOAc (3 x 100 mL). The combined organic extracts were repeatedly washed with saturated brine solution, dried over anhyd. Na_2SO_4 and concentrated under reduced pressure to give crude products which were purified by column chromatography [silica gel (230-400 mesh)] using petroleum ether: EtOAc (8:2) as an eluent to afford corresponding vicinal azido alcohol (**6m**) in 88% (1.7 g) yield.

[048] Example 4:

Synthesis of Chloramphenicol (8):

To a stirred solution of Specific compound name need to be provided (**6m**) (1.5 g, 7.7 mmol) in methanol (40 ml) was added 20% $Pd(OH)_2/C$ (50 mg) carefully at room temperature (25°C to 30°C) and a H_2 balloon was kept to provide hydrogen atmosphere. After the completion of the reaction as monitored by TLC, it was filtered over celite and the filtrate was concentrated under reduced pressure to give aminodiol, which was added methyl dichloroacetate (3 mL) and heated at a temperature ranging between 90 °C- 100°C for 1-1.5 hours. The excess ester was removed under reduced pressure to give the crude product. To a stirred solution of conc. HNO_3: conc. H_2SO_4 (1:1) (5 mL) was added the crude product at a temperature ranging between -20 °C to -30°C, the resulting solution was stirred for 1.5 h at 0 °C. After the completion of the reaction as monitored by TLC, it was poured into water and extracted with diethylether (3x50 mL), washed with water, brine and dried over anhydrous Na_2SO_4 and concentrated under reduced pressure to give crude product which were purified by column chromatography [silica gel (230-400 mesh)] using petroleum ether: EtOAc (6:4) as an eluent to afford chloramphenicol (**8**) in 71% yield.

Yield: 71% (1.8g); colorless gum; R_f = 0.40 (Pet ether: EtOAc = 7: 3); **IR** ($CHCl_3$, cm^{-1}) ν_{max} 850, 1049, 1216, 1348, 1416, 1454, 1523, 1604, 1686, 2929, 3020, 3420; **^{1}H NMR** (400 MHz, acetone- d_6) δ 3.58 - 3.88 (m, 2H), 4.09 - 4.17 (m, 1H), 4.52 (br. s., 3H), 5.25 (s, 1H), 6.10 (s, 1H), 7.60 (d, *J* = 8.5 Hz, 2H), 8.09 (d, *J* = 8.5 Hz, 2H); **^{13}C NMR** (100 MHz, acetone- d_6) δ 55.9, 60.6, 65.7, 69.6, 122.3, 126.3, 146.3, 149.2, 163.4; **HRMS** calcd for $[(C_{11}H_{12}Cl_2N_2O_5+Na)^+]$ 345.0015; found: 345.0009.

[049] Example 5:

General experimental procedure for the preparation of vicinal azido alcohols (7a-n):

To a stirred solution of alkene (1 mmol) in DMSO: DMF (4 ml: 4 ml) at 0 °C was added I_2 (10 mol %) followed by dropwise addition of 50% aqueous H_2O_2 (2 mmol, 0.140 mL). The addition of Et_3N (1 mmol, 0.140 mL) was then done slowly (vigorous decolorisation of reaction mixture was observed) and finally sodium azide (2 mmol, 130 mg) was added pinchwise. The reaction mixture was then allowed to stir at room temperature for 8 hours (monitored by TLC). Organic layer was diluted with EtOAc. The organic layer was separated and the aqueous layer was extracted with EtOAc (3 x 20 mL). The combined organic extracts were repeatedly washed with saturated brine solution, dried over anhyd. Na_2SO_4 and concentrated under reduced pressure to give crude products which were purified by column chromatography [silica gel (230-400 mesh)] using petroleum ether: EtOAc (8:2) as an eluent to afford corresponding vicinal azido alcohol (**7a-n**) in 74-92% yield.

1) 2-azido-2-phenylethan-1-ol (7a)

Yield: 82% (150 mg); Colorless liquid; R_f = 0.35 (Pet ether: EtOAc = 8: 2); **IR** ($CHCl_3$, cm^{-1}) ν_{max} 1026, 1105, 1227, 2106, 2847, 2933, 3416; **^{1}H NMR** (400 MHz,$CDCl_3$) δ 2.02 (s, 1H), 3.74 (t, *J* = 5.6 Hz, 2H), 4.68 (t, *J* = 6.4 Hz, 1H), 7.33 - 7.41 (m, 5H); **^{13}C NMR** (50 MHz,$CDCl_3$) δ 66.3, 67.7, 127.1, 128.6, 128.8, 136.2 ; **HRMS** calcd for $[(C_8H_9N_3O +Na)^+]$ 186.0638; found: 186.0640.

2) 2-azido-2-(p-tolyl)ethan-1-ol (7b)

Yield: 89% (158 mg); Colorless liquid; R_f = 0.35 (Pet ether: EtOAc = 8: 2); **IR** ($CHCl_3$, cm^{-1}) ν_{max} 752, 1232, 2104, 2893, 2950, 3021, 3382; **^{1}H NMR** (200 MHz, $CDCl_3$) δ 2.35 (s, 3H), 3.69 (d, *J* = 6.4 Hz, 2H), 4.60 (t, *J* = 6.4 Hz, 1H), 7.19 (s, 4H); **^{13}C NMR** (50 MHz, $CDCl_3$) δ 21.1, 66.3, 67.6, 127.1, 129.5, 133.2, 138.4; **HRMS** calcd for [$(C_9H_{11}N_3O$ +Na)$^+$] 200.0794; found: 200.0793;

Data of 7(c) need to be included

3) 2-azido-2-(2-bromophenyl)ethan-1-ol (7d)

Yield: 86% (205 mg); Colorless liquid; R_f = 0.35 (Pet ether: EtOAc = 8: 2); **IR** ($CHCl_3$, cm^{-1}) ν_{max} 761, 1032, 1255, 2103, 2931, 3367; **^{1}H NMR** (500 MHz,$CDCl_3$) δ 2.24 (br. s., 1H), 3.63 (t, *J* = 9.6 Hz, 1H), 3.87 (d, *J* = 11.0 Hz, 1H), 5.18 (dd, *J* = 8.1, 3.7 Hz, 1H), 7.19 - 7.22 (m, 1H), 7.37 (t, *J* = 7.3 Hz, 1H), 7.46 (d, *J* = 7.6 Hz, 1H), 7.59 (d, *J* = 7.9 Hz, 1H); **^{13}C NMR** (125 MHz,$CDCl_3$) δ 65.4, 66.7, 123.1, 128.0, 128.5, 129.9, 133.1, 135.8; **HRMS** calcd for [$(C_8H_8BrN_3O$ +Na)$^+$] 263.9743; found: 263.9739.

4) 2-azido-2-(3-nitrophenyl)ethan-1-ol (7e)

Yield: 76% (158 mg); Colorless liquid; R_f = 0.35 (Pet ether: EtOAc = 8: 2); **IR** ($CHCl_3$, cm^{-1}) ν_{max} 757, 1350, 1530, 1631, 2107, 2925, 3085, 3413; **^{1}H NMR** (500 MHz, $CDCl_3$) δ2.81 (dd, *J* = 5.4, 2.5 Hz, 1H), 3.24 (dd, *J* = 5.4, 4.0 Hz, 1H), 3.98 (dd, *J* = 3.9, 2.5 Hz, 1H), 7.55 (t, *J* = 7.6 Hz, 1H), 7.62 (d, *J* = 7.6 Hz, 1 H), 8.17 - 8.19 (m, 2H); **^{13}C NMR** (125 MHz, $CDCl_3$) δ51.4, 76, 120.7, 123.1, 129.6, 131.4, 140.1; **HRMS** calcd for [$(C_8H_8N_4O_4$+H)$^+$] 209.0674 found 209.0670.

5) 2-azido-2-phenylpropan-1-ol (7f)

Yield: 83% (146 mg); Colorless liquid; R_f = 0.35 (Pet ether: EtOAc = 8: 2); **IR** ($CHCl_3$, cm^{-1}) ν_{max} **^{1}H NMR** (200 MHz,$CDCl_3$) δ 1.43 (s, 3H), 2.32 (s, 1H), 3.50 (d, *J* = 11.3 Hz, 1H), 3.67 (d, *J* = 11.3 Hz, 1H), 7.21 - 7.37 (m, 5H); **^{13}C NMR** (50 MHz, $CDCl_3$) δ 26.0, 70.9, 74.8, 125.1, 127.1, 128.4, 145.0; **HRMS** calcd for [$(C_9H_{11}N_3O$ +Na)$^+$] 200.0794; found: 200.0794.

6) 2-azidooctan-1-ol (7g)

Yield: 83% (142 mg); Colorless liquid; R_f = 0.50 (Pet ether: EtOAc = 8: 2); **IR** ($CHCl_3$, cm^{-1}) ν_{max} **^{1}H NMR** (200 MHz,$CDCl_3$) δ 0.87 - 0.93 (m, 3H), 1.30 (br. s., 8H), 1.50 (d, *J* = 5.2 Hz, 2H), 1.95 (br. s., 1H), 3.41 - 3.60 (m, 2H), 3.62 - 3.76 (m, 1H); **^{13}C NMR** (50 MHz, $CDCl_3$) δ 14.1, 22.6, 26.0, 29.1, 30.6, 31.7, 64.5, 65.2; **HRMS** calcd for [($C_8H_{17}N_3O$+Na)$^+$] 194.1264; found:194.1263.

7) 2-azido-4-(benzyloxy)-2-methylbutan-1-ol (7h)

Yield: 74% (172 mg); Colorless liquid; R_f = 0.45 (Pet ether: EtOAc = 8: 2); **IR** ($CHCl_3$, cm^{-1}) ν_{max} 744, 1104, 1292, 2102, 2867, 2926, 3460; **^{1}H NMR** (400 MHz,$CDCl_3$) δ 1.25 (s, 3H), 1.64 (s, 1H), 1.74 - 1.81 (m, 1H), 1.92 – 1.99 (m, 1H), 3.24 (s, 2H), 3.58 (s, 1H), 3.70 - 3.76 (m, 2H), 4.55 (s, 2H), 7.31 - 7.40 (m, 5H); **^{13}C NMR** (100 MHz,$CDCl_3$) δ 25.0, 37.5, 60.5, 66.9, 72.8, 73.4, 127.8, 127.9, 128.5, 137.4; **HRMS** calcd for [($C_{12}H_{17}N_3O_2$+Na)$^+$] 258.1213; found: 258.1209.

8) 3-azido-1-(benzyloxy)-3-methylbutan-2-ol (7i)

Yield: 78% (185 mg); Colorless liquid; R_f = 0.45 (Pet ether: EtOAc = 8: 2); **IR** ($CHCl_3$, cm^{-1}) ν_{max} 771,1077, 1456, 2121, 2924, 3416; **^{1}H NMR** (500 MHz,$CDCl_3$) δ 1.17 (s, 3H), 1.23 (s, 3H), 2.16 (s, 1H), 3.55 - 3.59 (m, 2H), 3.64 (d, *J* = 8.2 Hz, 1H), 4.54 (dd, *J* = 12.2, 4.6 Hz, 2H), 7.31 - 7.38 (m, 5H); **^{13}C NMR** (125 MHz, $CDCl_3$) δ25.2, 26.6, 71.5, 71.8, 73.7, 75.6, 127.8, 128.0, 128.5, 137.5; **HRMS** calcd for [($C_{12}H_{17}N_3O_2$+Na)$^+$] 258.1213; found: 258.1210.

9) *Anti*-2-azidocyclohexan-1-ol (7j)

Yield: 92% (130 mg); Colorless liquid; R_f = 0.35 (Pet ether: EtOAc = 9: 1); **IR** ($CHCl_3$, cm^{-1}) ν_{max} 764, 1285,1455, 2100, 3410; **^{1}H NMR** (400 MHz,$CDCl_3$) δ 1.25 - 1.33 (m, 4H), 1.65 - 1.8 (br. s, 2H), 1.97- 2.04 (m, 2H), 2.76 (br. s., 1H), 3.12 - 3.18 (m, 1H), 3.35 (dt, *J* = 9.6, 4.5 Hz, 1H); **^{13}C NMR** (100 MHz,$CDCl_3$) δ 23.8, 24.1, 29.7, 33.0, 66.9, 73.4; **HRMS** calcd for [($C_6H_{11}N_3O$ +Na)$^+$] 164.0794; found: 164.0794.

10) *Anti* -2-azido-2,3-dihydro-1H-inden-1-ol (7k)

Yield: 82% (144 mg); Colorless liquid; R_f = 0.40 (Pet ether: EtOAc = 8: 2); **IR** ($CHCl_3$, cm^{-1}) ν_{max} 761, 1219, 2098, 2844, 2926, 3366; **^{1}H NMR** (400 MHz,$CDCl_3$) δ

2.86 (dd, *J* = 16.0, 5.9 Hz, 1 H), 3.28 (dd, *J* = 16.0, 6.7 Hz, 1H), 3.44 (br. s, 1H), 4.46 (q, *J* = 5.9 Hz, 1H), 4.65 (d, *J* = 4.9 Hz, 1H), 7.29-7.39 (m, 4H); **^{13}C NMR** (100 MHz,$CDCl_3$) δ 35.2, 65.7, 76.4, 124.7, 125.1, 127.6, 129.0, 139.0, 141.9; **HRMS** calcd for [($C_9H_9N_3O$+Na)$^+$] 198.0638; found:198.0640.

11) *Anti*-1-azido-1-phenylpropan-2-ol (7l)

Yield: 86% (152 mg); Colorless liquid R_f = 0.35 (Pet ether: EtOAc = 8: 2); **IR** ($CHCl_3$, cm^{-1}) ν_{max} 759, 1269, 2109, 2829, 2950, 3020, 3322; **^{1}H NMR** (200 MHz,$CDCl_3$) δ 1.11 (d, *J* = 6.2 Hz, 3H), 1.63 (br. s., 1H), 3.88 (quin, *J* = 6.1 Hz, 1H), 4.38 (d, *J* = 5.8 Hz, 1H), 7.23 - 7.35 (m, 5H); **^{13}C NMR** (50 MHz,$CDCl_3$) δ 18.6 , 70.6, 71.6, 127.8, 128.6, 128.9, 136.3; **HRMS** calcd for [($C_9H_{11}N_3O$ +Na)$^+$] 200.0794; found: 200.0794.

12) *Anti*-3-azido-3-phenylpropane-1,2-diol (7m)

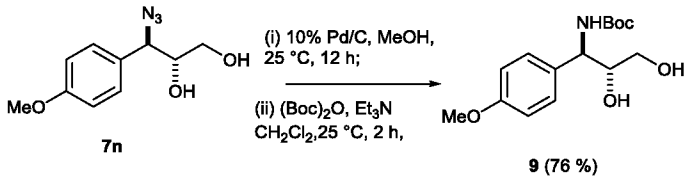
Yield: 78% (112 mg); Colorless liquid; R_f = 0.25 (Pet ether: EtOAc = 6: 4); **IR** ($CHCl_3$, cm^{-1}) ν_{max} 777, 1309, 1604, 2107, 2933, 3014, 3389; **^{1}H NMR** (400 MHz,$CDCl_3$) δ 2.68 (br. s., 2 H), 3.61 - 3.71 (m, 2H), 3.80 (td, *J* = 6.4, 3.3 Hz, 1H), 4.59 (d, *J* = 7.1 Hz, 1H), 7.34 - 7.44 (m, 5H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ 62.8, 67.1, 74.0, 127.8, 128.8, 129.0, 136.2; **HRMS** calcd for [($C_9H_{11}N_3O_2$+Na)$^+$] 216.0749 found: 216.0745.

13) 3-azido-3-(4-methoxyphenyl)propane-1,2-diol (7n)

Yield: 80% (890 mg); colorless liquid; R_f = 0.25 (Pet ether: EtOAc = 6: 4); **IR** ($CHCl_3$, cm^{-1}) ν_{max} 1035, 1195, 1513, 1616, 2100, 2920, 3050, 3368 (broad); **^{1}H NMR** (200 MHz,$CDCl_3$) δ 2.73 (br. s., 1H), 3.21 - 3.68 (m, 2H), 3.74 - 3.82 (m, 4H), 4.52 (d, *J* = 7.2 Hz, 1 H), 6.92 (d, *J* = 8.7 Hz, 2 H), 7.27 (d, *J* = 8.7 Hz, 2 H); **^{13}C NMR** (101 MHz, $CDCl_3$) δ 55.2, 63.0, 66.4, 73.9, 114.3, 128.0, 129.1, 159.8; **HRMS** calcd for [($C_{10}H_{13}N_3O_3$+H)$^+$] 224.1035 found: 224.1036.

[050] Example 6:

Synthesis of Tert-butyl *anti*-2,3-dihydroxy-1-(4-methoxyphenyl)propyl)carbamate (9):

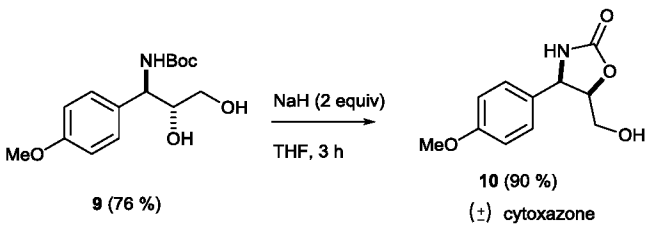


To a stirred solution of azidoalcohol **7n** (0.5g, 2.2 mmol) in MeOH (20 mL) was added 20% $Pd(OH)_2/C$ (25 mg) carefully at room temperature and a H_2 balloon was kept to provide hydrogen atmosphere. After the completion of the reaction as monitored by TLC, it was filtered over celite and the filtrate was concentrated under reduced pressure to give aminodiol, which was added $(Boc)_2O$ (2.4 m mol, 0.487 g) and Et_3N (4.4 mmol, 0.44 g) and allowed to stir at a temperature ranging from 25 °C for 2 hours. After the completion of the reaction as monitored by TLC, it was poured into water and extracted with diethylether (3x50 mL), washed with water, brine and dried over anhydrous Na_2SO_4 and concentrated under reduced pressure to give crude product which were purified by column chromatography [silica gel (230-400 mesh)] using petroleum ether: EtOAc (6:4) as an eluent to afford compound **9** in 76% yield (496 mg).

Yield: 76% (496 mg); colorless liquid; R_f = 0.25 (Pet ether: EtOAc = 5: 5); **mp:** 114-116 °C, (lit.[67] **mp**: 116-118 °C); **IR** ($CHCl_3$, cm^{-1}) ν_{max} 669, 757, 831, 927, 1035, 1167, 1216, 1368, 1585, 1612, 1701, 2400, 2839, 2981, 3019, 3438, 3682; **^{1}H NMR** (500 MHz, $CDCl_3$) δ 1.34 (br. s., 10H), 3.01 - 3.25 (m, 1H), 3.54 (br. s., 2H), 3.71 (s, 4H), 4.55 (br. s., 1H), 5.29 (br. s., 1H), 6.78 (d, *J* = 5.5 Hz, 2H), 7.15 (d, *J* = 6.7 Hz, 2H): **^{13}C NMR** (126 MHz, $CDCl_3$) δ 28.3, 55.2, 56.1, 63.2, 74.1, 76.7, 77.3, 80.1, 96.1, 114.2, 128.5, 131.1, 156.2, 159.2; **HRMS** calcd for $[(C_{15}H_{24}NO_5+H)^+]$ 298.1654 found: 298.1650.

[051] Example 7:

Synthesis of (4R,5R)-5-(hydroxymethyl)-4-(4-methoxyphenyl) oxazolidin-2-one (10):

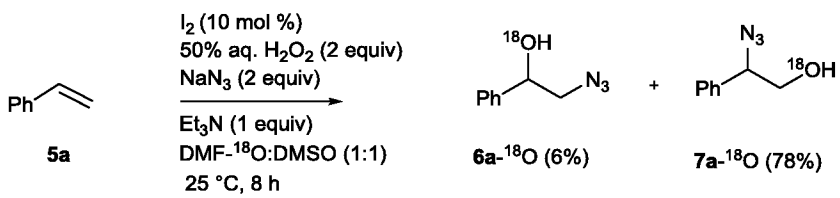


To a solution of *anti*-3-amino-1,2-diol **9** (0.3 g, 1.0 mmol) in dry THF (10 mL) was added NaH (0.05 g, 60% w/w, 2.0 mmol) at a temperature ranging from 25 °C, and the mixture was stirred under nitrogen atmosphere for 3 hours. The reaction mixture was concentrated and the resulting mixture was extracted with EtOAc (3 x 10 mL), washed with saturated aq. NH_4Cl (5 mL) and brine solution (5 mL). The organic layers were separated, dried over anhyd. Na_2SO_4, and concentrated to give the crude product, which was then purified by column chromatography over silica gel using pet. ether:EtOAc (60:40) as am eluent to give **10** (0.2 g) as a colorless solid.

Yield: 90% (335 mg); colorless solid; **mp:** 116-118 °C, (lit.[67] **mp**: 119-121 °C); R_f = 0.25 (Pet ether: EtOAc = 7: 3); **IR** ($CHCl_3$, cm^{-1}) ν_{max} 769, 843, 1028, 1248, 1395, 1513, 1610, 1733, 2580, 2924, 3272; **^{1}H NMR** (500 MHz, *DMSO-d_6*) δ 3.00 - 3.03 (m, 2H), 3.26 (t, *J* = 3.7 Hz, 2H), 3.77 (s, 3H), 4.69- 4.71 (m, 2H), 4.88 (d, *J* = 8.2 Hz, 1H), 6.89 (dd, *J* = 8.4, 2.0 Hz, 2H), 7.15 (d, *J* = 8.5 Hz, 2H), 7.98 (br. s., 1H): **^{13}C NMR** (126 MHz, *DMSO-d_6*) δ 39.0, 39.2, 39.3, 39.7, 39.8, 40.0, 54.8, 56.3, 60.9, 78.4, 78.6, 78.9, 80.0, 95.5, 113.4, 127.8, 129.0, 158.6, 158.9. **HRMS** calcd for $[(C_{11}H_{13}NO_4+H)^+]$ 224.0922; found: 224.0920.

[052] Example 8:

Synthesis of 2-azido-2phenylethan-1-ol (^{18}O-7a):



To a stirred solution of styrene (0.5 mmol) in DMSO: ^{18}O-DMF (which was purified and prepared by dimethylaminomethylene dimethylamm-onium chloride) and ^{18}O-H_2O

(>97%-18O) heating in 110 °C for 12 hours) (0.5 ml: 0.5 ml) at 0 °C was added I_2 (10 mol %) followed by dropwise addition of 50% aqueous H_2O_2 (1 mmol). The addition of Et_3N (0.5 mmol) was then done slowly (vigorous decolorisation of reaction mixture was observed) and finally sodium azide (1 mmol) was added pinchwise. The reaction mixture was then allowed to stir at room temperature for 8 hours (monitored by TLC). Organic layer was diluted with EtOAc. The organic layer was separated and the aqueous layer was extracted with EtOAc (3 x 8 mL). The combined organic extracts were repeatedly washed with saturated brine solution, dried over anhyd. Na_2SO_4 and concentrated under reduced pressure to give crude products which were purified by column chromatography [silica gel (230-400 mesh)] using petroleum ether: EtOAc (8:2) as an eluent to afford corresponding vicinal azido alcohol (**^{18}O-7a)** in 78% yield and (**^{18}O-6a)** in 6% yield. The ^{1}HNMR and ^{13}C NMR data was in well agreement as **7a** and **6a** compounds. **HRMS** calcd for [$(C_8H_9N_3O+H)^+$] 166.0861; found: 166.0860.

[054] ADVANTAGES OF THE INVENTION:

- Cheaper Oxidising system, High regio selectivity as well as diastereoselectivity
- Metal free process
- Room Temperature process
- High yield

WE CLAIM:

1. A one step room temperature process for the selective synthesis of regio and diastereo 1,2-azidoalcohols from alkenes comprising
    a. adding halogen source to a stirred solution of alkene substrate in a solvent system followed by addition of co-oxidant at 0°C to -5°C;
    b. adding base to reaction mixture of step (a) followed by addition of azide source at a temperature ranging between 0°C to -5°C;
    c. stirring the reaction mixture of step (b) at a temperature ranging between 25 to 30°C for 8-12 hours to afford 1,2-azidoalcohols.
2. The process as claimed in claim 1, wherein said azide source is sodium azide.
3. The process as claimed in claim 1, wherein said halogen source is iodine solution, tetra-n-butylammonium iodide, sodium iodide, potassium iodide.
4. The process as claimed in claim 1, wherein said base is selected from triethylamine (Et_3N), potassium carbonate (K_2CO_3), potassium tert-butoxide (K^tOBu), sodium hydride (NaH), 1,8-Diazabicycloundec-7-ene (DBU).
5. The process as claimed in claim 1, wherein said solvent is selected from water, acetonitrile, ethylacetate and C_1 to C_3 alcohols, dimethylsulfoxide (DMSO), dimethyl formamide (DMF), acetone, dioxane, tetrahydrofuran (THF), N,N-dimethylacetamide (DMA) or combinations thereof.
6. The process as claimed in claim 1, wherein said solvent system is DMSO and DMF in a ratio of 1: 1(volume/volume).
7. The process as claimed in claim 1, wherein said co-oxidant is selected from anhydrous tert-butyl hydroperoxide (TBHP) or 30%-50% aq. H_2O_2 at the temperature ranging from 25°C to 35°C.
8. The process as claimed in claim 1, wherein yield of said process is in the range of 70-95%.
9. The process as claimed in claim 1, wherein said process is metal free.

10. Novel regio and diastereo 1,2-azidoalcohols are included 2-azido-1-(2-bromophenyl)ethan-1-ol, 1-azido-2-phenylpropan-2-ol, 1-azido-4-(benzyloxy)-2-methylbutan-2-ol, 3-azido-4-(benzyloxy)-2-methylbutan-2-ol, Syn-2-azido-1-phenylpropane-1,3-diol, 2-azido-1-(4-methoxyphenyl)propane-1,3-diol, 2-azido-2-phenylethan-1-ol, 2-azido-2-(p-tolyl)ethan-1-ol, 2-azido-2-(2-bromophenyl)ethan-1-ol, 2-azido-2-(3-nitrophenyl)ethan-1-ol, 2-azido-4-(benzyloxy)-2-methylbutan-1-ol, 3-azido-1-(benzyloxy)-3-methylbutan-2-ol, 3-azido-3-(4-methoxyphenyl)propane-1,2-diol.
11. A process for preparation of chloramphenicol from 1,2-azidoalcohol of claim 1 comprising the steps of:
    a) adding 20% palladium hydroxide on carbon to a stirred solution of azidoalcohol in methanol under H_2 atmosphere at a temperature ranging between 25°C to afford aminodiol;
    b) adding methyl dichloroacetate into aminodiol of step (a) and heating the solution at a temperature ranging around 90°C for 1 hour to afford crude product;
    c) Adding crude product of step (b) into nitrating mixture at a temperature ranging around -20°C;
    d) Stirring the solution of step c at a temperature of 0°C for 1 hour to afford chloramphenicol.
12. The process as claimed in claim 11, wherein said 1,2-azidoalcohol is Syn-2-azido-1-phenylpropane-1,3-diol.
13. The process as claimed in claim 11, wherein said nitrating mixture of step (c) is mixture of nitric acid and sulphuric acid.(conc. HNO_3: conc. H_2SO_4 (1:1)).
14. A process for preparation of tert-butyl anti-2,3-dihydroxy-1-(4-methoxyphenyl)propyl)carbamate from 1,2-azidoalchohol of claim 1 comprising the steps of:

a) adding 20% palladium hydroxide on carbon to a stirred solution of azidoalcohol in solvent under H_2 atmosphere at a temperature ranging between 25°C for 12 hours to afford aminodiol;

b) adding Boc anhydride ($(Boc)_2O$) and triethyl amine (Et_3N) to a stirred solution of step (a) in dicholoromethane and allowing stirring at a temperature ranging from 25°C for 2 hours to afford Tert-butyl anti-2,3-dihydroxy-1-(4-methoxyphenyl)propyl)carbamate .

15. The process as claimed in claim 14, wherein said 1,2-azidoalcohol is 3-azido-3-(4-methoxyphenyl)propane-1,2-diol.

16. A process for preparation of (4R,5R)-5-(hydroxymethyl)-4-(4-methoxyphenyl) oxazolidin-2-one from tert-butyl anti-2,3-dihydroxy-1-(4-methoxyphenyl)propyl)carbamate comprising adding sodium hydride to a solution of tert-butyl anti-2,3-dihydroxy-1-(4-methoxyphenyl)propyl)carbamate in dry THF under nitrogen temperature at a temperature ranging from 25°C to 30°C, stirring continued for 3-3.5 hours to afford (4R,5R)-5-(hydroxymethyl)-4-(4-methoxyphenyl) oxazolidin-2-one.

INTERNATIONAL SEARCH REPORT

International application No
PCT/IN2016/050020

A. CLASSIFICATION OF SUBJECT MATTER
INV. C07C247/10
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
C07C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data, CHEM ABS Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	MADHAN A ET AL: "Stereoselective synthesis of (-)-cytoxazone", TETRAHEDRON ASYMMETRY, PERGAMON PRESS LTD, OXFORD, GB, vol. 12, no. 14, 14 August 2001 (2001-08-14), pages 2009-2011, XP004307295, ISSN: 0957-4166, DOI: 10.1016/S0957-4166(01)00340-8 cheme 1, step f ----- -/--	1-9, 11-15

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
1 April 2016	23/06/2016

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Gutke, Hans-Jürgen

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Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IN2016/050020

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-9, 11-15

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	Rama Rao et al: "Asymmetric Synthesis of Chloramphenicol", J Chem Soc, 1 January 1992 (1992-01-01), XP055260057, Retrieved from the Internet: URL:http://pubs.rsc.org/en/content/article pdf/1992/c3/c39920000859 [retrieved on 2016-03-21] compound 10	1-9, 11-15
X	WO 2013/044092 A1 (AMGEN INC [US]; WHITE RYAN [US]; CHENG YUAN [US]; MINATTI ANA ELENA [U) 28 March 2013 (2013-03-28) pages 101-102, steps 3 and 4	1-9, 11-15
X,P	P. K. PRASAD ET AL: "Oxidant controlled regio- and stereodivergent azidohydroxylation of alkenes via I 2 catalysis", CHEMICAL COMMUNICATIONS - CHEMCOM, vol. 51, no. 51, 20 April 2015 (2015-04-20), pages 10276-10279, XP055260201, GB ISSN: 1359-7345, DOI: 10.1039/C5CC02374B page 10277, left column; page 10279, left column, second sentence	1-9, 11-15

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/IN2016/050020

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2013044092 A1	28-03-2013	EP 2758406 A1	30-07-2014
		JP 2014526560 A	06-10-2014
		US 2014296226 A1	02-10-2014
		US 2016159818 A1	09-06-2016
		WO 2013044092 A1	28-03-2013

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-9, 11-15

   process to prepare azido alcohols from alkenes

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2. claim: 10

   certain specific 1,2-azidoalcohols

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3. claim: 16

   process to prepare (4R,5R)-5-hydroxymethyl-4(4-methoxyphenyl) oxazolidin-2-one

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