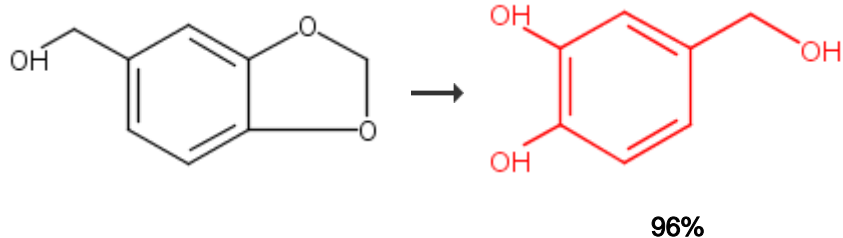


1. Single Step[Overview](#)**Steps/Stages**

- 1.1 R:Na, R:(CH₂OH)₂, S:(CH₂OMe)₂, rt → reflux; reflux
- 1.2 R:(Me₂N)₃P=O, 12 h, 165°C
- 1.3 R:HCl, S:H₂O, rt, acidify

Notes

Reactants: 1, Reagents: 4, Solvents: 2, Steps: 1, Stages: 3, Most stages in any one step: 3

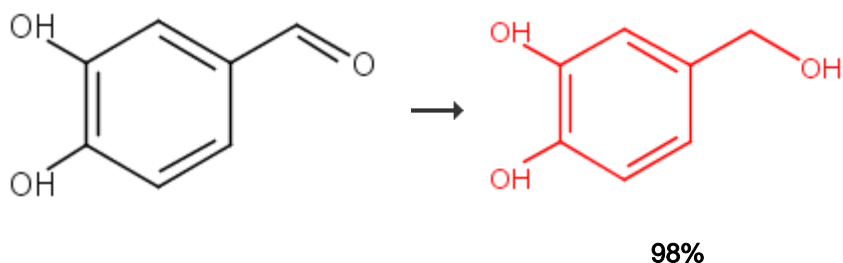
References

[Method for the preparation of hydroxytyrosol and 3-\(3,4-dihydroxyphenyl\)propanol from methylenedioxybenzenes](#)

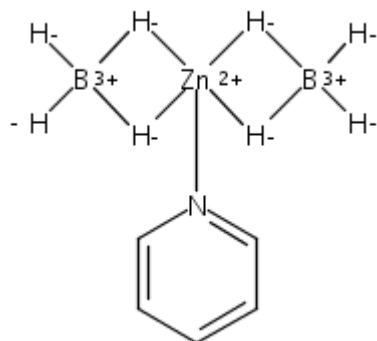
By Alvarez De Manzaneda Roldan, Enrique et al

From PCT Int. Appl., 2009153374, 23 Dec 2009

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2. Single Step[Overview](#)**Steps/Stages**

- 1.1 R:



S:Et₂O, 1.6 h, rt

- 1.2 R:HCl, S:H₂O, 30 min, rt

Notes

Reactants: 1, Reagents: 2, Solvents: 2, Steps: 1, Stages: 2, Most stages in any one step: 2

References

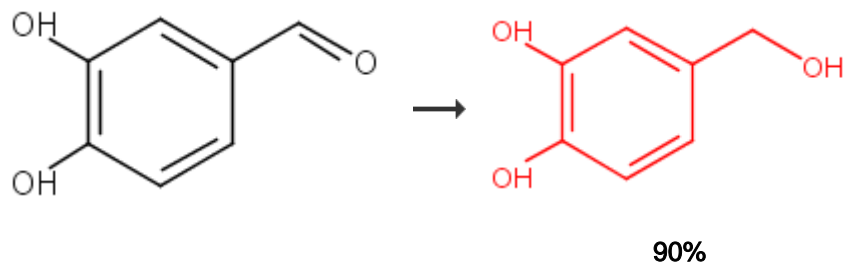
[\(Pyridine\)\(tetrahydroborato\)zinc complex, \[Zn\(BH₄\)₂\(py\)\], as a new stable, efficient and chemoselective reducing agent for reduction of carbonyl compounds](#)

By Zeynizadeh, Behzad and Faraji, Fariba

From Bulletin of the Korean Chemical Society, 24(4), 453-459; 2003

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3. Single Step



Overview

Steps/Stages

1.1 R:NaBH₄, S:MeOH, 1-4 h, 0°C

Notes

Reactants: 1, Reagents: 1, Solvents: 1, Steps: 1, Stages: 1, Most stages in any one step: 1

References

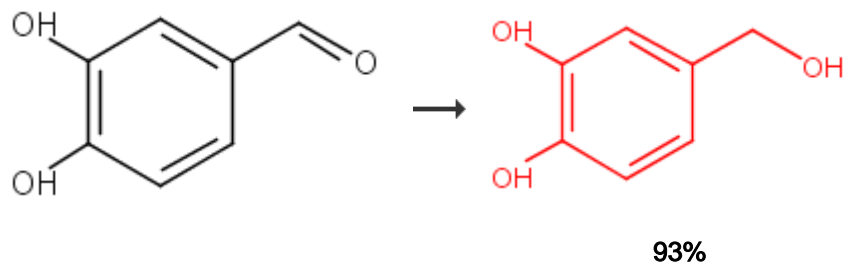
[Synthesis of L-ascorbic acid lactone derivatives](#)

By Shao, Li-Dong et al

From Natural Products and Bioprospecting, 4(3), 181-188; 2014

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4. Single Step



Overview

Steps/Stages

1.1 R:NaBH₄, C:945566-52-9, S:H₂O, S:THF, 55 min, rt

Notes

Reactants: 1, Reagents: 1, Catalysts: 1, Solvents: 2, Steps: 1, Stages: 1, Most stages in any one step: 1

References

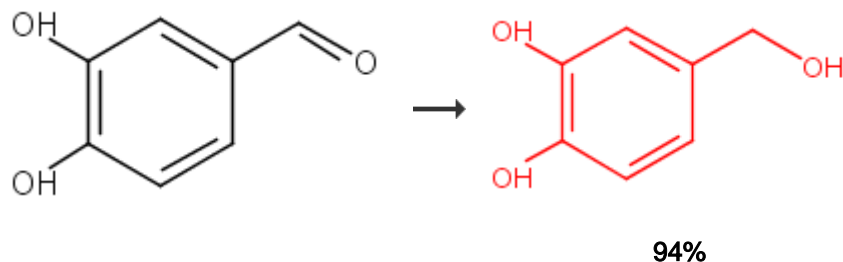
[Cross-linked poly\(diallyldimethylammonium chloride\) as an efficient solid-liquid phase transfer catalyst in reduction of carbonyl compounds with sodium borohydride](#)

By Mahdavi, H. et al

From Reactive & Functional Polymers, 66(10), 1033-1040; 2006

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5. Single Step



Overview

Steps/Stages

- 1.1 R:NaBH₄, C:14024-64-7, S:MeCN, 10 min, rt
- 1.2 R:H₂O, 10 min, rt

Notes

Reactants: 1, Reagents: 2, Catalysts: 1, Solvents: 1, Steps: 1, Stages: 2, Most stages in any one step: 2

References

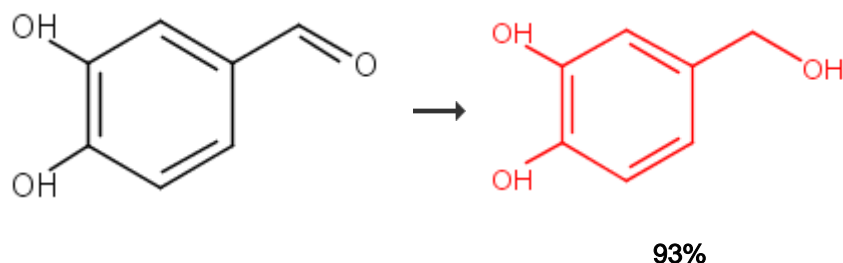
[Titanyl acetylacetonate as an efficient catalyst for a mild and convenient reduction of carbonyl compounds with NaBH₄ under aprotic condition](#)

By Zeynizadeh, Behzad

From Zeitschrift fuer Naturforschung, B: Chemical Sciences, 58(12), 1220-1226; 2003

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6. Single Step



Overview

Steps/Stages

- 1.1 R:NaBH₄, S:THF, 30 min, rt

Notes

chemoselective, ultrasound, Reactants: 1, Reagents: 1, Solvents: 1, Steps: 1, Stages: 1, Most stages in any one step: 1

References

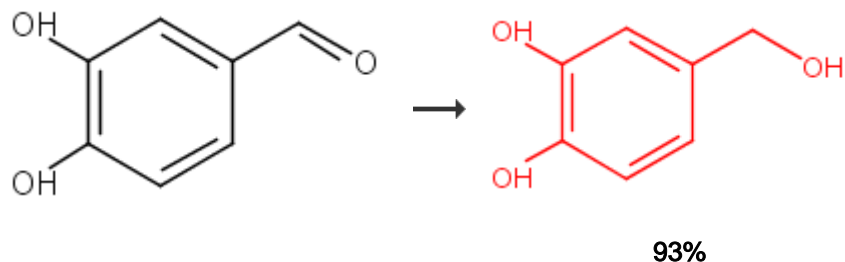
[Reduction of carbonyl compounds with NaBH₄ under ultrasound irradiation and aprotic conditions](#)

By Zeynizadeh, Behzad and Yahyaei, Saiedeh

From Zeitschrift fuer Naturforschung, B: Chemical Sciences, 59(6), 704-710; 2004

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7. Single Step



Overview

Steps/Stages

- 1.1 R:NaBH₄, S:MeCN, rt
- 1.2 R:MoCl₅, 3 min, rt
- 1.3 S:H₂O, 5 min, rt

Notes

Reactants: 1, Reagents: 2, Solvents: 2, Steps: 1, Stages: 3, Most stages in any one step: 3

References

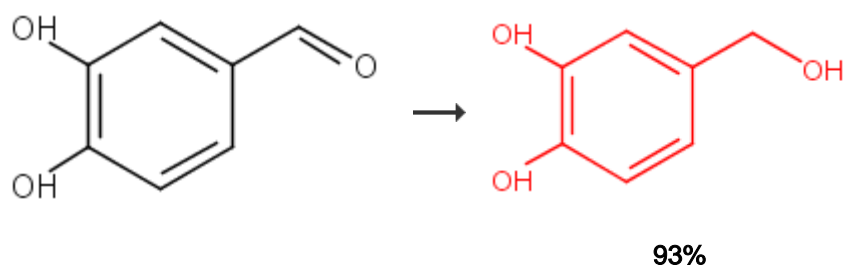
[A mild and convenient method for the reduction of carbonyl compounds with NaBH₄ in the presence of catalytic amounts of MoCl₅](#)

By Zeynizadeh, Behzad and Yahyaei, Saiedeh

From Bulletin of the Korean Chemical Society, 24(11), 1664-1670; 2003

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8. Single Step

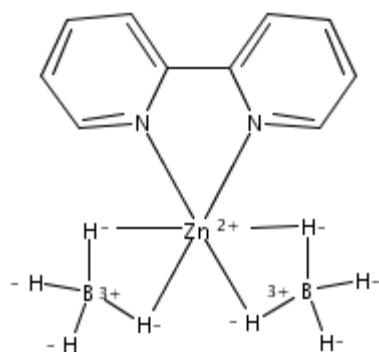


Overview

Steps/Stages

Notes

1.1 R:



S:MeCN, 25 min, rt

Reactants: 1, Reagents: 2, Solvents: 2, Steps: 1, Stages: 2, Most stages in any one step: 2

References

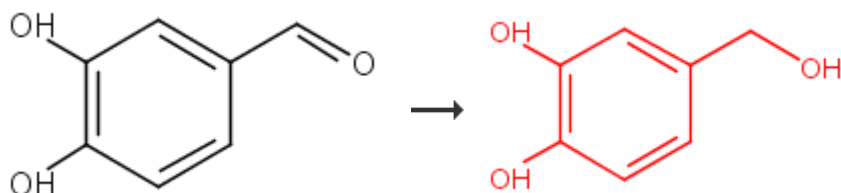
Modified hydroborate agent: (2,2'-bipyridyl)(tetrahydroborato)zinc complex, $[\text{Zn}(\text{BH}_4)_2(\text{bpy})]$, as a new, stable, efficient ligand-metal hydroborate and chemoselective reducing agent

By Zeynizadeh, Behzad

From Bulletin of the Chemical Society of Japan, 76(2), 317-326; 2003

1.2 R:FeCl₃, S:H₂O, 20 min, rt

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9. Single Step

91%

[Overview](#)**Steps/Stages**1.1 R:NaBH₄, C:Dowex 1X8, S:THF, 0.25 h, rt**Notes**

chemoselective, Reactants: 1, Reagents: 1, Catalysts: 1, Solvents: 1, Steps: 1, Stages: 1, Most stages in any one step: 1

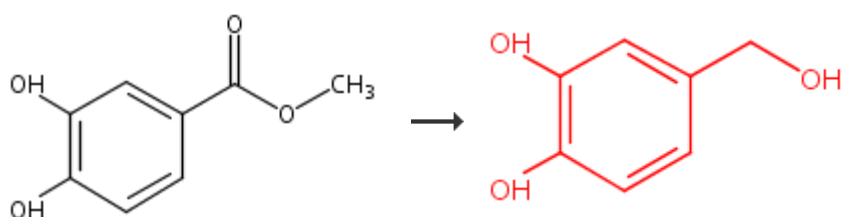
References

Mild and efficient method for reduction of aldehydes and ketones with NaBH₄ in the presence of Dowex 1-x8

By Zeynizadeh, Behzad and Shirini, Farhad

From Journal of Chemical Research, Synopses, (6), 335-339; 2003

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10. Single Step

[Overview](#)**Steps/Stages**1.1 R:LiAlH₄, S:THF, 8 h, 0°C**Notes**

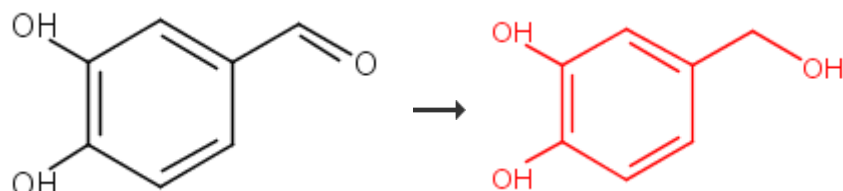
Reactants: 1, Reagents: 1, Solvents: 1, Steps: 1, Stages: 1, Most stages in any one step: 1

References[Design, synthesis and biological evaluation of small molecular polyphenols as entry inhibitors against H5N1](#)

By Yang, Jian et al

From Bioorganic & Medicinal Chemistry Letters, 24(12), 2680-2684; 2014

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11. Single Step

72%

[Overview](#)**Steps/Stages**1.1 S:H₂O, 30 h, rt**Notes**

biotransformation, green chemistry, green chemistry-solvent, alternative reaction conditions shown, coconut juice from *Cocos nucifera* used as catalyst, green chemistry-reagent, green chemistry-catalyst, Reactants: 1, Solvents: 1, Steps: 1, Stages: 1, Most stages in any one step: 1

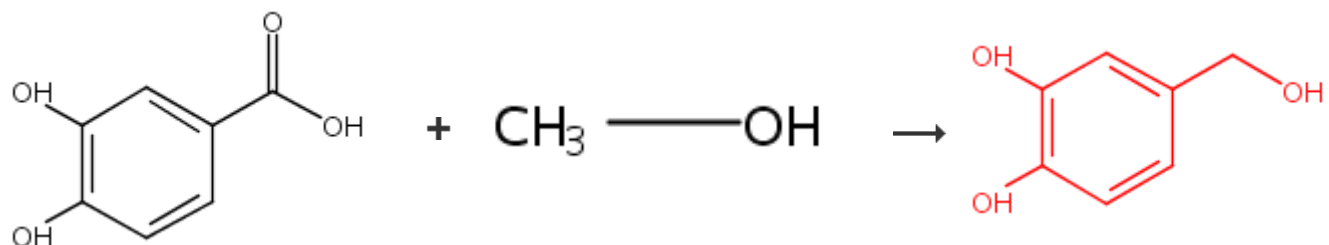
References[New greener alternatives for bioreduction of aromatic aldehydes and decarboxylation of aromatic acids using juice of fruits](#)

By Misra, Kaushik et al

From Journal of Molecular Catalysis B: Enzymatic, 82, 92-95; 2012

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12. 2 Steps



Overview

Steps/Stages

- 1.1 R:SOCl₂, 8 h, rt
- 2.1 R:LiAlH₄, S:THF, 8 h, 0°C

Notes

Reactants: 2, Reagents: 2, Solvents: 1, Steps: 2, Stages: 2, Most stages in any one step: 1

References

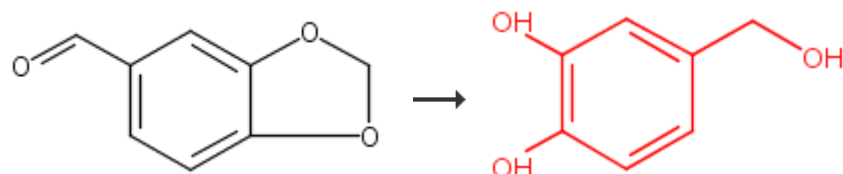
[Design, synthesis and biological evaluation of small molecular polyphenols as entry inhibitors against H5N1](#)

By Yang, Jian et al

From *Bioorganic & Medicinal Chemistry Letters*, 24(12), 2680-2684; 2014

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13. 2 Steps



Overview

Steps/Stages

- 1.1 R:NaBH₄, S:EtOH, 8 h, rt
- 2.1 R:Na, R:(CH₂OH)₂, S:(CH₂OMe)₂, rt → reflux; reflux
- 2.2 R:(Me₂N)₃P=O, 12 h, 165°C
- 2.3 R:HCl, S:H₂O, rt, acidify

Notes

Reactants: 1, Reagents: 5, Solvents: 3, Steps: 2, Stages: 4, Most stages in any one step: 3

References

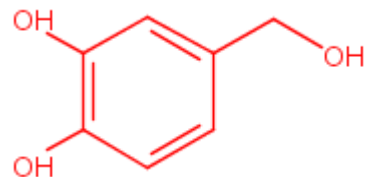
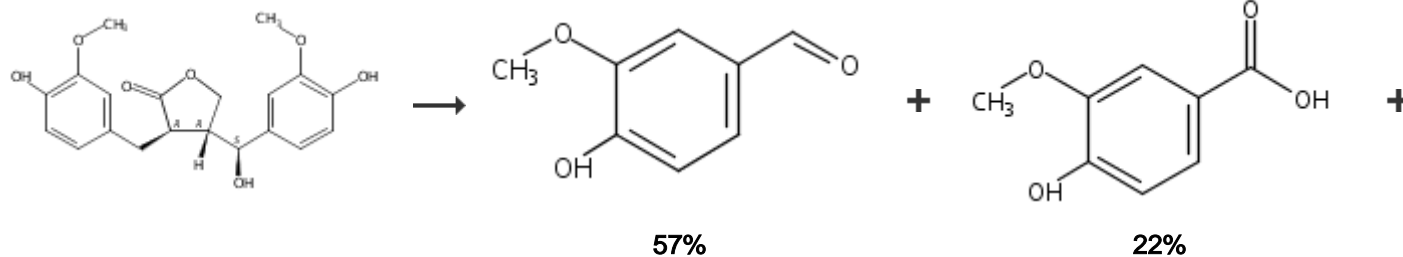
[Method for the preparation of hydroxytyrosol and 3-\(3,4-dihydroxyphenyl\)propanol from methylenedioxybenzenes](#)

By Alvarez De Manzaneda Roldan, Enrique et al

From *PCT Int. Appl.*, 2009153374, 23 Dec 2009

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14. Single Step



13%

[Overview](#)**Steps/Stages**

- 1.1 R:AcOH, R:H₂O₂, C:1308-56-1, S:H₂O, 1-2 min, rt, pH 4; 1 h, 60°C

Notes

other products also detected, green chemistry, buffered solution (sodium acetate), Reactants: 1, Reagents: 2, Catalysts: 1, Solvents: 1, Steps: 1, Stages: 1, Most stages in any one step: 1

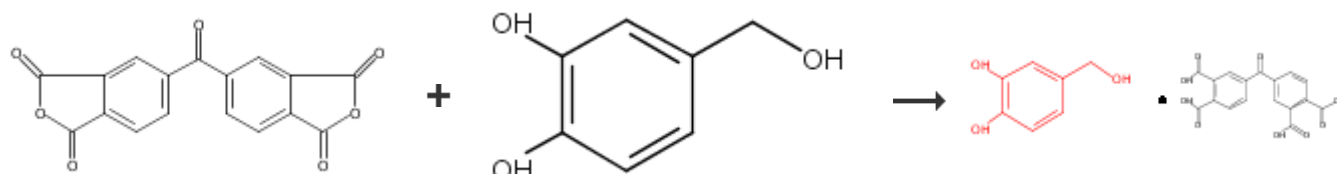
References

[Selective Conversion of Biorefinery Lignin into Dicarboxylic Acids](#)

By Ma, Ruoshui et al

From ChemSusChem, 7(2), 412-415; 2014

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15. Single Step[Overview](#)**Steps/Stages**

- 1.1 R:Et₃N, S:NMP, 30 min, rt

Notes

Reactants: 2, Reagents: 1, Solvents: 1, Steps: 1, Stages: 1, Most stages in any one step: 1

References

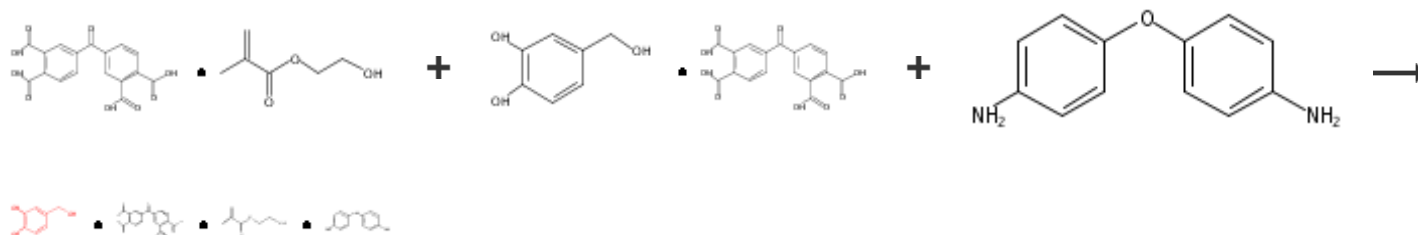
[Alkaline-developable photosensitive polyimide compositions forming sharp insulation patterns and their preparation](#)

By Hojo, Yasuhiro

From Jpn. Kokai Tokkyo Koho, 2002275262, 25 Sep 2002

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16. Single Step

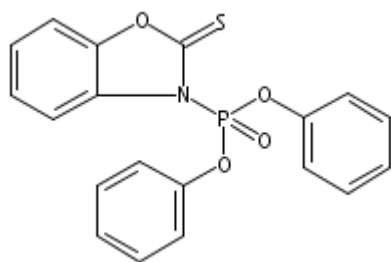


Overview

Steps/Stages

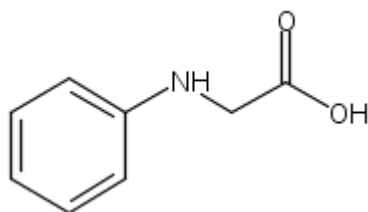
1.1 30 min, rt

1.2 R:



rt; 5 h, rt

1.3 R:

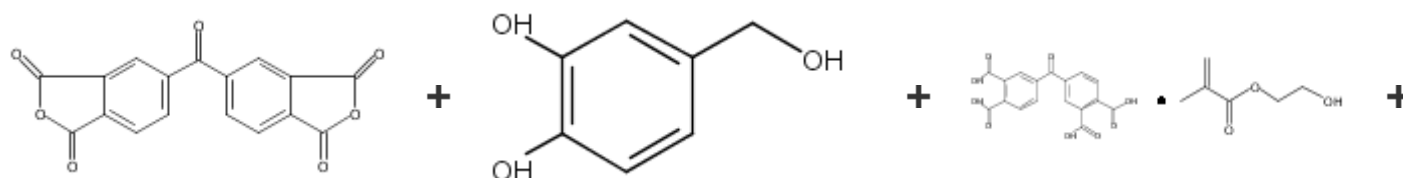


S:NMP, 1 min, 90°C

1.4 R:Me₄N⁺ •OH⁻, 1 h, 150°C; 1 h, 250°C; 1 h, 350°C

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17. 2 Steps



[Step 2.1]

Notes

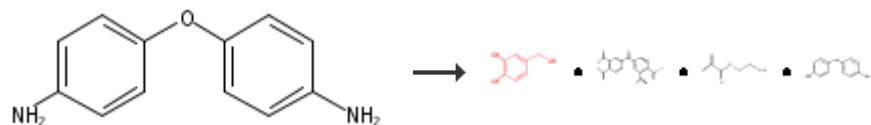
photochemical in stage 3, 365 nm used in stage 3, Reactants: 3, Reagents: 3, Solvents: 1, Steps: 1, Stages: 4, Most stages in any one step: 4

References

[Alkaline-developable photosensitive polyimide compositions forming sharp insulation patterns and their preparation](#)

By Hojo, Yasuhiro

From Jpn. Kokai Tokkyo Koho, 2002275262, 25 Sep 2002

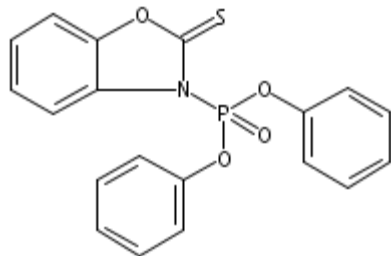


[Step 2.1]

[Overview](#)**Steps/Stages**1.1 R:Et₃N, S:NMP, 30 min, rt

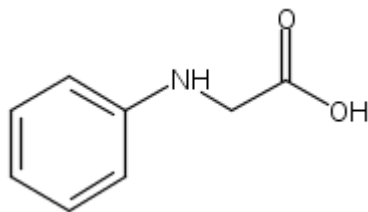
2.1 30 min, rt

2.2 R:



rt; 5 h, rt

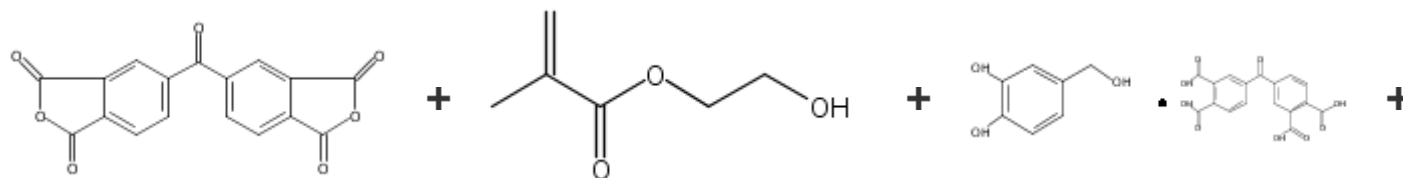
2.3 R:



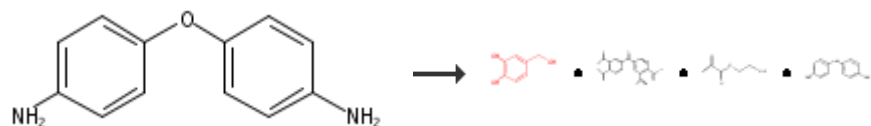
S:NMP, 1 min, 90°C

2.4 R:Me₄N⁺ •OH⁻, 1 h, 150°C; 1 h, 250°C; 1 h, 350°C

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18. 2 Steps

[Step 2.1]



[Step 2.1]

[Overview](#)**Steps/Stages****Notes**

2) photochemical in stage 3, 365 nm used in stage 3, Reactants: 4, Reagents: 4, Solvents: 1, Steps: 2, Stages: 5, Most stages in any one step: 4

References

[Alkaline-developable photosensitive polyimide compositions forming sharp insulation patterns and their preparation](#)

By Hojo, Yasuhiro

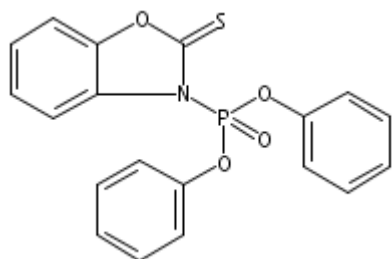
From Jpn. Kokai Tokkyo Koho, 2002275262, 25 Sep 2002

Notes

1.1 R:Et₃N, S:NMP, 30 min, rt

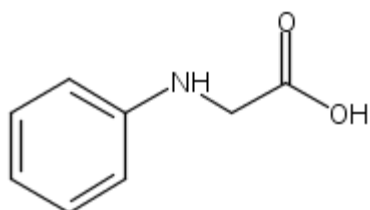
2.1 30 min, rt

2.2 R:



rt; 5 h, rt

2.3 R:

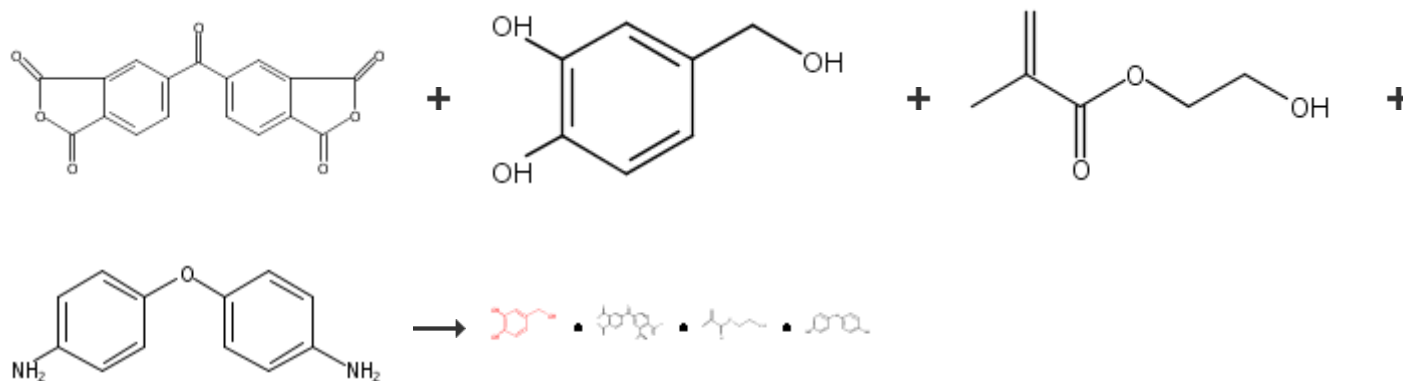


S:NMP, 1 min, 90°C

2.4 R:Me₄N⁺ • OH⁻, 1 h, 150°C; 1 h, 250°C; 1 h, 350°C

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19. 3 Steps (Converging)



[Overview](#)

Steps/Stages

2) photochemical in stage 3, 365 nm used in stage 3, Reactants: 4, Reagents: 4, Solvents: 1, Steps: 2, Stages: 5, Most stages in any one step: 4

References

[Alkaline-developable photosensitive polyimide compositions forming sharp insulation patterns and their preparation](#)

By Hojo, Yasuhiro

From Jpn. Kokai Tokkyo Koho, 2002275262, 25 Sep 2002

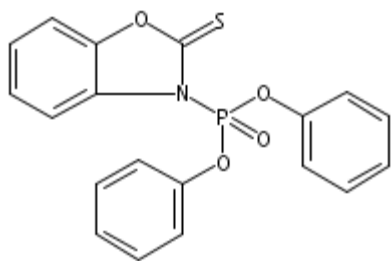
Notes

1.1 R:Et₃N, S:NMP, 30 min, rt

1.1 R:Et₃N, S:NMP, 30 min, rt

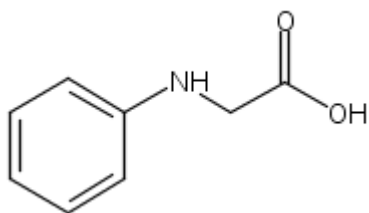
2.1 30 min, rt

2.2 R:



rt; 5 h, rt

2.3 R:



S:NMP, 1 min, 90°C

2.4 R:Me₄N⁺ •OH⁻, 1 h, 150°C; 1 h, 250°C; 1 h, 350°C

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photochemical in stage 3, 365 nm used in stage 3, Reactants: 4, Reagents: 4, Solvents: 1, Steps: 3, Stages: 6, Most stages in any one step: 4

References

[Alkaline-developable photosensitive polyimide compositions forming sharp insulation patterns and their preparation](#)

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