**L-Ascorbic Acid**

Compiled by Bernhard Füger

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**Introduction**

L-ascorbic acid, also known as Vitamin C, has an important role in physiology. As an essential vitamin, it has to be taken regulary by mammals which cannot produce it themselves. It serves to prevent desease and has proven to act beneficially in the human body. Moreover, it is used in large amounts in the food industry as a nutritional additive and as a radical scavenger to e.g. prevent the oxidative degradation of lipids in food. The oxidation of L-ascorbic acid (or its monooanion 1) proceeds via monodehydro-L-ascorbic acid (radical anion 2), which disproportionates to L-ascorbate (1) and dehydro-L-ascorbic acid (3) (Scheme 1).1

![Scheme 1](image1)

### Scheme 1

L-ascorbic acid can be synthesized in large amounts from D-glucose by a combination of chemical and microbiological steps in an overall yield of 66%.2

### Abstracts

(A) L-Ascorbic acid is able to react selectively as a C-nucleophile. Poss and Belter synthesized bicyclic natural product delesserine (9) from L-ascorbic acid derivative 7 and 4-hydroxybenzyl alcohol (8) in good yield. By use of substituted 4-hydroxybenzyl alcohol derivatives, natural products rhodomelol and methylrhodomelol could also be obtained.4

![Scheme 2](image2)

(B) The sodium salt of L-ascorbic acid is used as a reductant in the recently developed and widely applied copper(I)-catalyzed regioselective synthesis of 1,2,3-triazoles 12 from organic azides 10 and alkynes 11. Among the myriad of reactions of this type, the combination of CuSO4 hydrate and sodium ascorbate is the most utilized way to produce the catalytically active Cu(I) species.5

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(C) The conjugated electron-rich enediol moiety in L-ascorbic acid is an unusual and interesting functionality. Thopate et al. used a Paterno–Büchi reaction to convert L-ascorbic acid derivatives 13 into chiral oxetanes 14. These are attractive intermediates for the synthesis of chiral polyols 15 through ring-opening reactions.8

(D) The reductive desulfonylation of β-ketosulfoxones 16 takes place efficiently under irradiation with light (λ > 300 nm) in the presence of ascorbic acid, as described by Liu et al. Desulfonylated products 17 were obtained in excellent yields. Furthermore, double or triple bonds were left intact under these reaction conditions.7

(E) L-Ascorbic acid is an ideal educt for the synthesis of enantiomerically pure 4-substituted butenolides 19, which are important chiral synths for the synthesis of natural products. Godefroi and co-workers developed the synthesis of 19 by a dihydroxylation sequence starting from L-ascorbic acid (18).4

(F) Samuelson and co-workers described the synthesis of chiral platinum-bisphosphinite complexes 21 with a backbone stemming from 2-O-benzylated L-ascorbic acid 20. These complexes were successfully applied as catalysts in chemical transformations, e.g., in the asymmetric allylation of cinnamaldehyde (22) yielding chiral alcohol 23 in high yield and with good enantioselectivity.8

(G) Singh and Ram reported the palladium(II) chloride/EDTA catalyzed biaryl homocoupling of both electron-deficient and electron-rich aryl bromides 24 in the presence of L-ascorbic acid as reductant. Homocoupled products 25 with various substitution patterns were obtained in yields up to 84%.10 Compared to other homocoupling procedures, this method is environmentally safer, more selective and does not require an inert atmosphere.

(H) The reductive copper(I)-mediated amination of aromatic nitroso compounds 26 with aryl boronic acids 27 was described by Liebeskind and co-workers. Here, the use of L-ascorbic acid as the terminal reductant proved to be very beneficial and superior to other reducing agents. Diarylamines 28 were obtained with a variety of functional groups in good yields.11

References


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