GOVERNMENT OF ANDHRA PRADESH

COMMISSIONERATE OF COLLEGIATE EDUCATION

PRODUCTION OF VITAMIN-C

SUBJECT: CHEMISTRY

L.Sudheera. M.Sc., M.Phil.,

SKR & SKR Govt. College for Women (A), Kadapa

Email. Id : winnie.teja35@gmail.com

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INTRODUCTION

- Vitamin C is also known as L Ascorbic acid .
- It is a water soluble vitamin.
- Hence it is easily delivered to the body tissues but not well stored.
- Our body does not synthesize the vitamin C . So it must be taken regularly daily through food or good quality supplements.
- So it is an essential dietary component.

Vitamin C

- Important in controlling infections and healing wounds.
- It is powerful anti oxidant that can neutralize harmful free radicals.
- In the formation of collagen , a fibrous protein vitamin C is required which supports skin , bones and muscles.
- It is necessary for the growth, development and repair of all body tissues .
- It is involved in absorption of Iron, in proper functioning of immune system.
- Vitamin C helps in making several hormones and chemical messengers used in brain and nerves.

Absorption and storage

- Readily absorbed from the small intestine , peritoneum and subcutaneous tissues.
- Passes through the portal vein to the general circulation and to all tissues.
- Not stored in any organ and distributed throughout the body.
- Each organ or tissue has an optimal saturation level of Vitamin C .
- Excess of intake it does not increases the saturation level but the excess is excreted in the Urine.

SOURCES OF VITAMIN C

- Fruits and vegetables are the best sources of Vitamin C
- Richest sources :- Amla (Indian goose berry) Kakadu plum, Camu Camu.
- Good sources :- Citrus fruits, tomatoes, green peppers, raw cabbage, guava , cauliflower, Strawberries
- Fair sources :- Grapes, apple, banana, kiwi, jack fruit, green leafy vegetables , salad greens, Fresh potatoes, papaya

Vitamin C content of food reduced by prolonged storage and by cooking.

Amount of Vitamin C

Raw plant Source.	Amount of Vitamin C in mg/100 gms.
Kakadu plums	1000-5300
Camu camu	2800
Amla (Indian goose berry)	445
Guava	228

Amount of Vitamin C

Yellow Capsicum	183
Red Capsicum	128
Broccoli	90
Kiwi	90

Amount of Vitamin C

Straw berry	60	
Pappaya	60	
Orange/le mon	53	
cauliflowe r	48	

VITAMIN C

Pineapple	48	
Mango	28	
Potato	20	
Tomato	14	

Recommended Intakes in mg per day

Age	Male	Female	Pregnancy	Lactation
0-6 months	40	40		
7-12 months	50	50		
1-3 years	15	15		
4-8 years	25	25		
9-13 years	45	45		
14-18	75	65	80	115
19 + years	90	75	85	120

Vitamin C Deficiency

Acute vitamin C deficiency leads to scurvy.

Symptoms

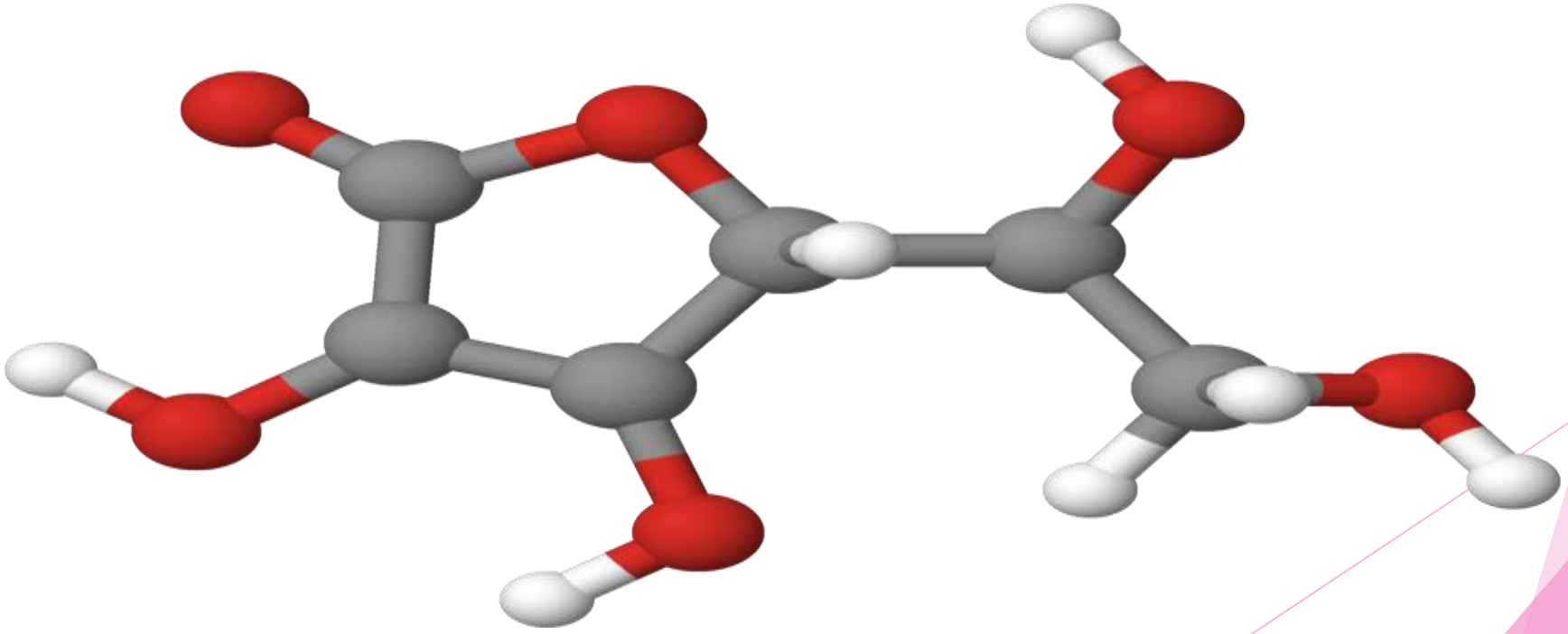
- Swelling or bleeding of gums.
- Hair loss
- Delayed healing of skin wounds
- Skin spots caused by bleeding and bruising from broken blood vessels.
- Fatigue, malaise.
- Iron deficiency anemia due to decreased absorption of non heme iron.
- Collagen synthesis becomes impaired and connective tissue become weakened.

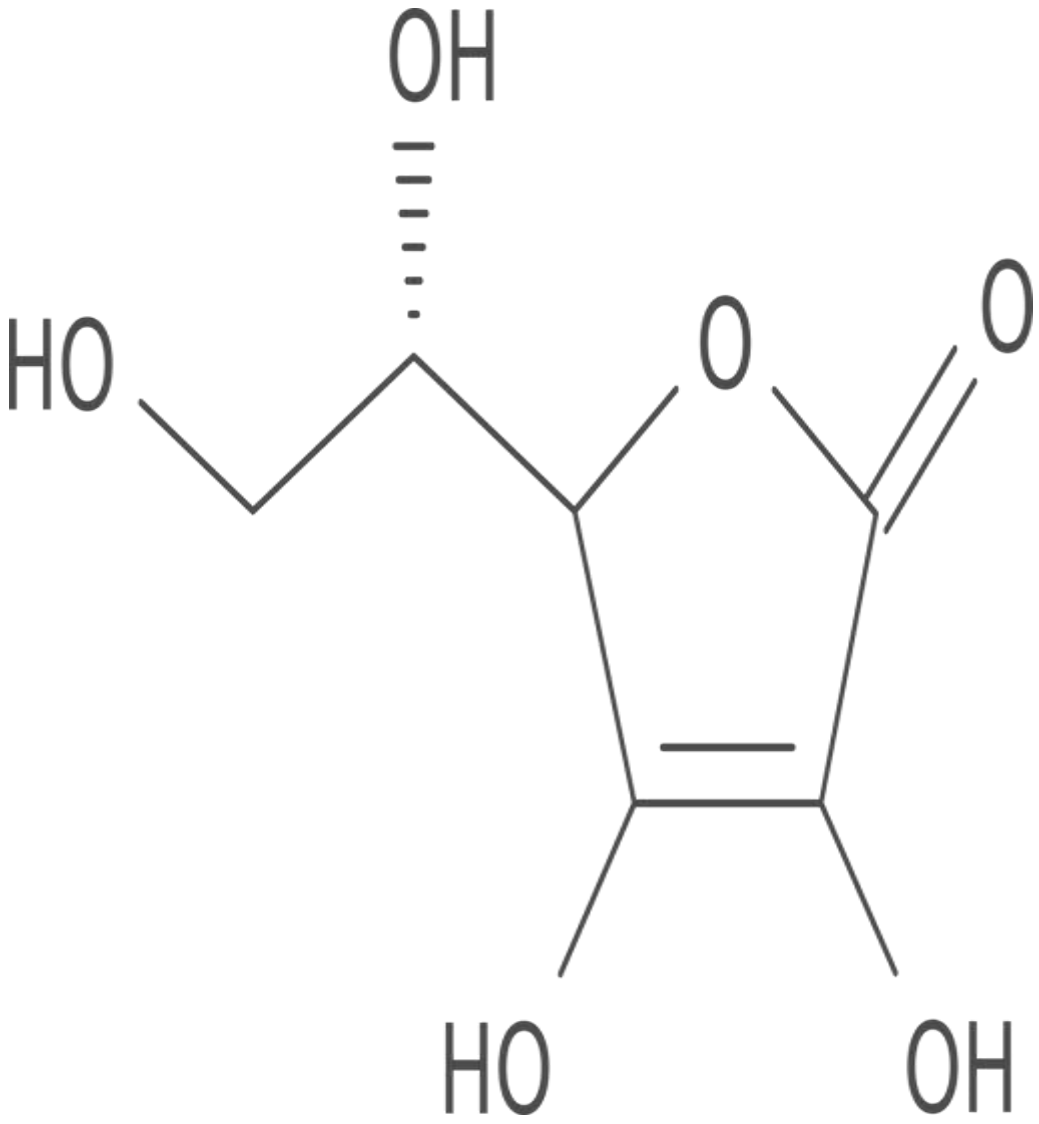
CHEMISRTRY OF VITAMIN C

Vitamin C is also called L Ascorbic acid.

M.F. $C_6 H_8 O_6$.

STRUCTURE :




OH
HO
O
O
HO
OH

PRODUCTION OF VITAMIN C

80% of world supply of Ascorbic acid is produced by Chaina.

The synthesis of Ascorbic acid was achieved by Reichstien in 1933.

Industrial protection of vitamin c two years later by Roche.

1. REICHSTEIN PROCESS

Reichstein process is outdated, but historically important industrial synthesis of Ascorbic acid from Glucose.

In the first step of this process glucose is catalytically hydrogenated to Sorbitol. In the next step Sorbitol is oxidized by microorganism Acetobactor Suboxydans to Sorbose. Only one of the six hydroxyl groups is oxidized by this enzymatic reaction. The Sorbose Acetone is treated with in presence of acid catalyst converts the four of the remaining hydroxyl groups to Acetals. The unprotected hydroxyl group is oxidized to carboxylic acid by the KMnO4 as bleaching solution. Acid catalyzed hydrolysis of Diaceto 2- Keto L-sorbicacid by removal of two Acetal groups and ring closing lactonization yields L Ascorbic Acid i.e is Vitamin C with more than

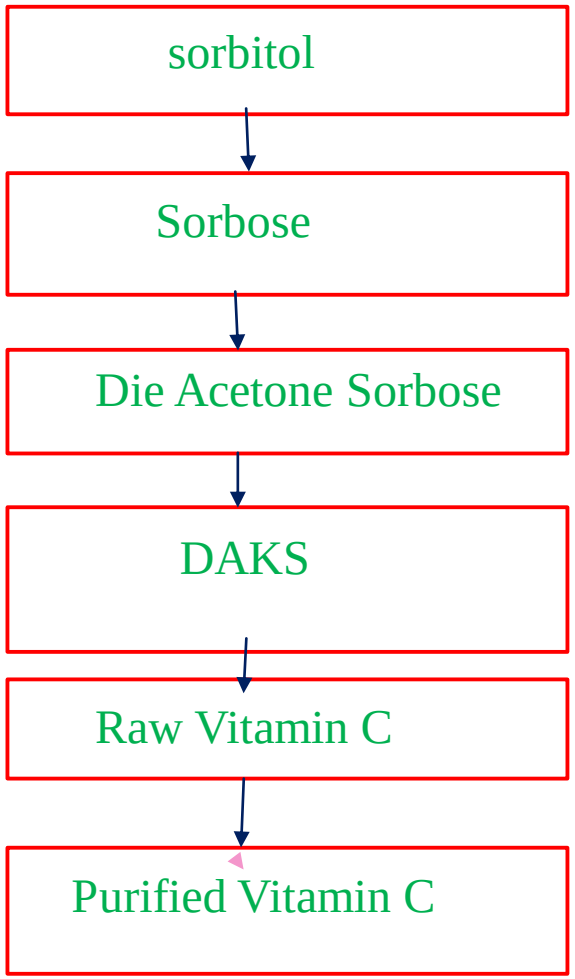
2. TWO STEP FERMENTATION PROCESS

It is developed in China in 1960, further developed in 1990.

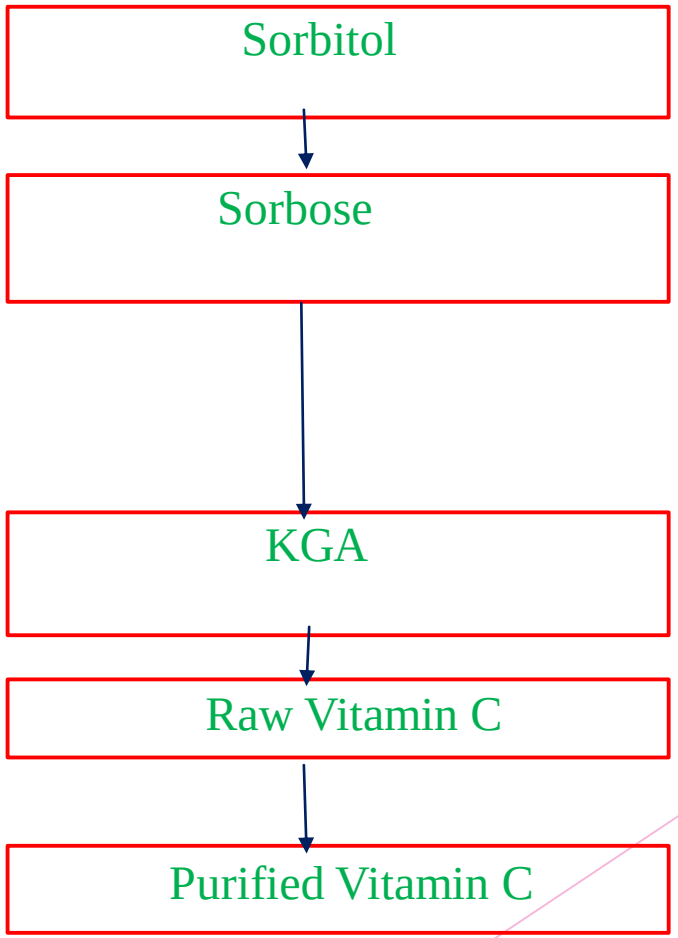
In this process a second genetically modified microle species such as mutant Erwinia oxidizes Sorbose to 2- Keto gluconic acid (2KGA) which is then undergo ring closing Lactonization via dehydration to yield L Ascorbic acid.

Vitamin C Reichstein , Two step fermentation Process

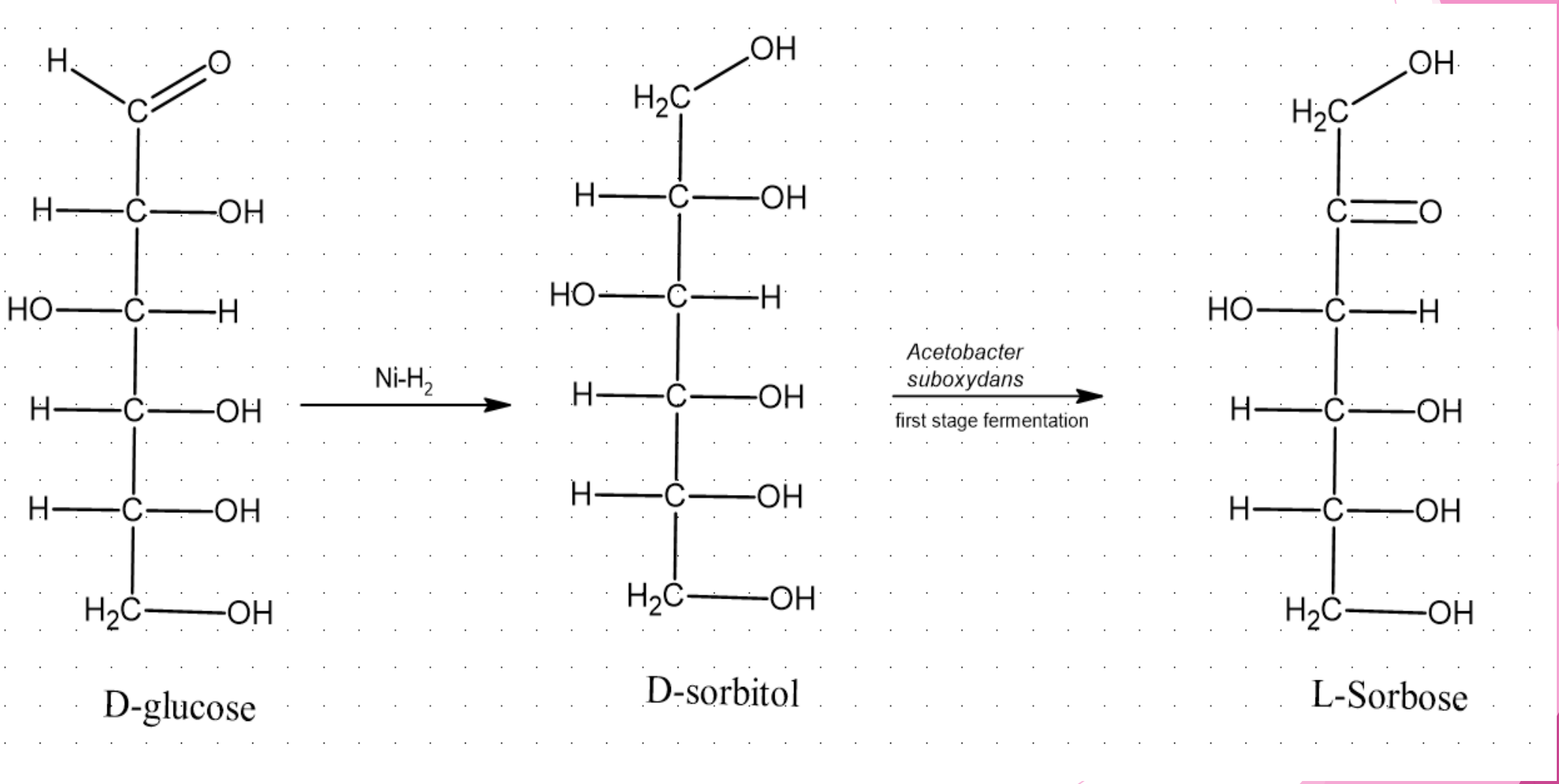
Reichstein Process

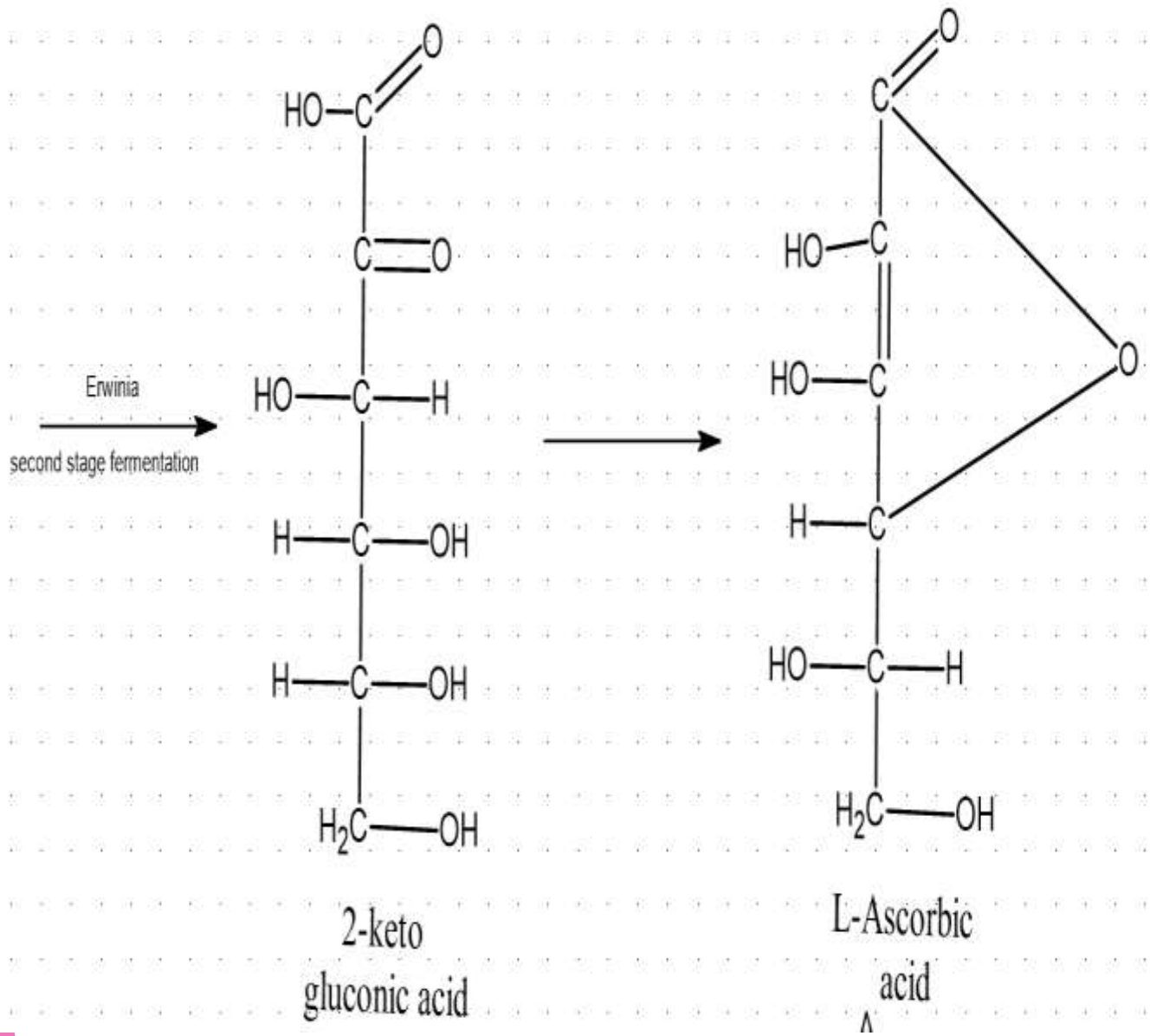


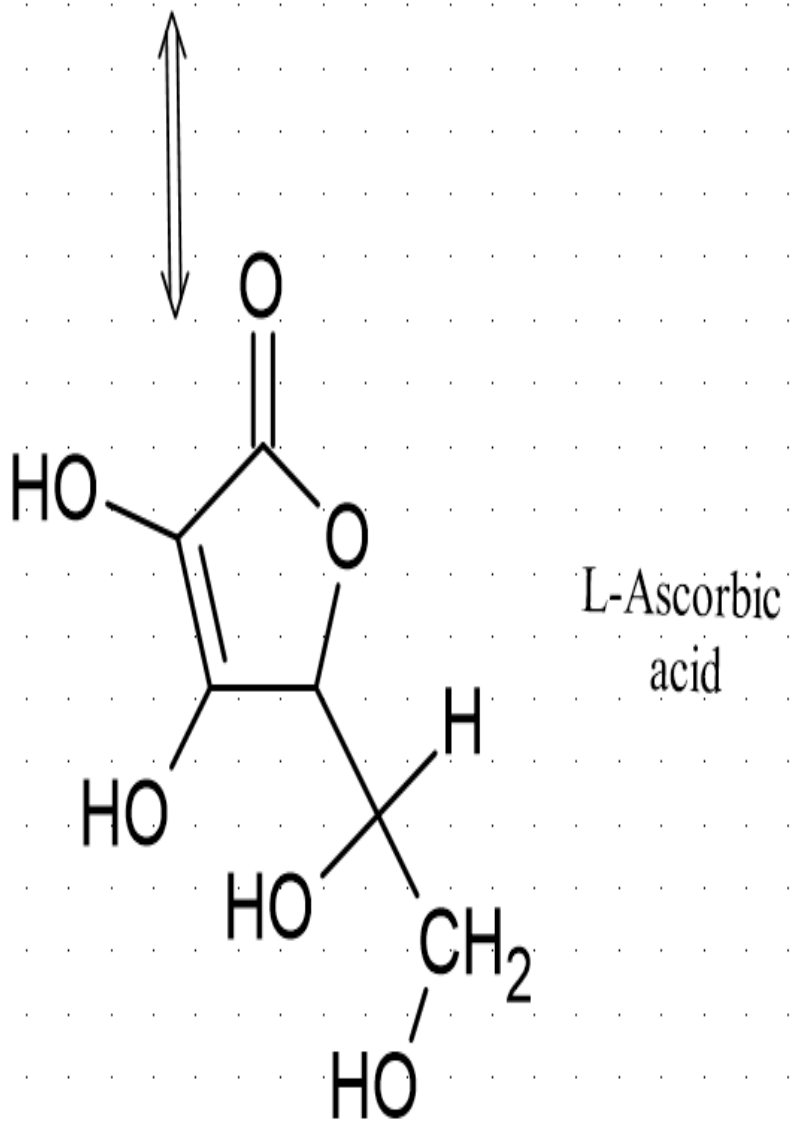
Two step fermentation process



Two Step Fermentation Process




Erwinia
second stage fermentation
2-keto
gluconic acid
L-Ascorbic
acid


L-Ascorbic
acid

Why Reichstein process not eco – friendly?

- Explosive gas H_2 is used
- Requires high temperature and pressure energy intensive.
- Protecting group is used.
- Acetone and $KMnO_4$ are toxic to environment.
- Low atom economy (40%).

Not ideal from green Chemistry point of view.

Why green-based on green chemistry on following principles.

- Prevent waste
- Maximize atom economy
- Design less hazardous chemical synthesis.
- Increase energy efficiency
- Avoid chemical derivatives.
- Use catalysts, not stoichiometric reagents.
- Minimize the potential for accidents.

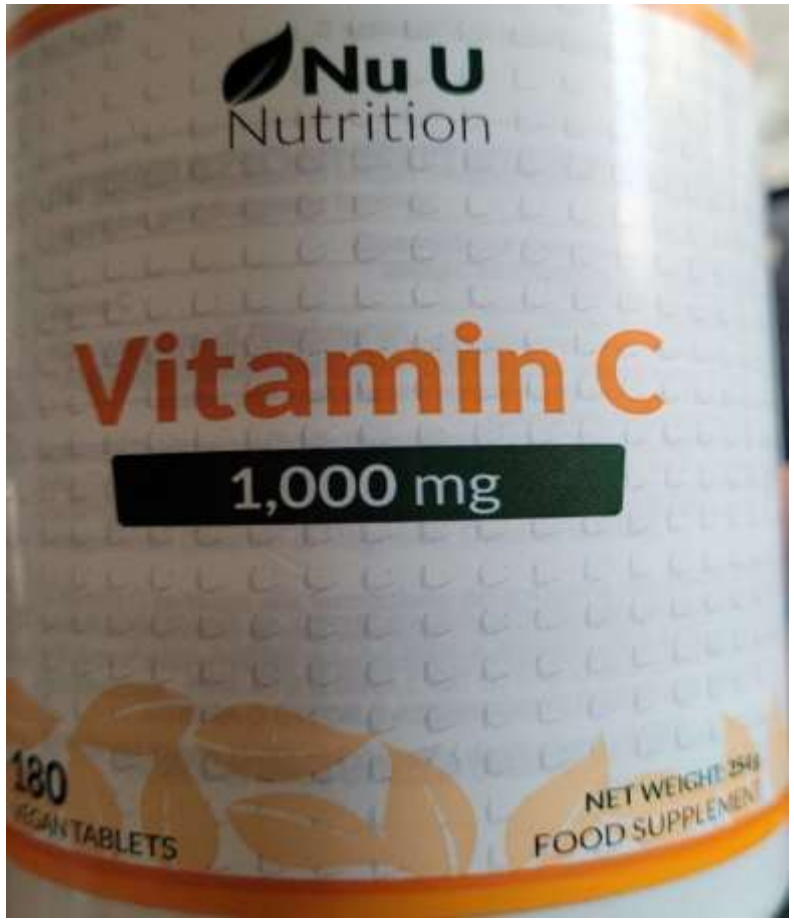
Vitamin C Supplements

- Vitamin C dietary supplements are available as tablets, capsules, drink mix packets in multivitamin /mineral formulations with ranges from 25mg to 1500 mg per serving.
- Vitamin C is also added to some fruit juices and juice drinks.

The most commonly used Vitamin C supplement compounds are Ascorboic acid ,sodium ascorbate and calcium ascorbate.

- Compared to plant sources animal sourced foods do not provide very less amount of Vitamin C.

Vitamin C Supplements




Emergen-C
1,000 MG
Vitamin C
DIETARY SUPPLEMENT
Super Orange
24
Nutrients
7
B Vitamins
Electrolytes
Antioxidants

CONCLUSION

- Nowadays, health has become the most important property of human life after pandemic covid period.
- Diets with high content of fruits and vegetables are protective against several human diseases and even cancer.
- Therefore people are putting more attention on antioxidant substances such as Vitamin C.
- In the food industry Vitamin C is used as food additive.

THANK YOU