Unit I - Topic 8

MECHANISM OF ANTIOXIDANTS

Antioxidants - Food Additive:

A biological antioxidant may be defined as a substance(present in low concentrations compared to an oxidizable substrate) that significantly delays or inhibits oxidation of a substrate.

Substances that neutralize potential ill effect of free radicals are generally grouped in so called a Antioxidant defense system (ADS).

Such a system encompasses many substances which are often called by the generic names such as Antioxidants, Free radical scavengers, Chain terminators or Reductants.

Mechanism:

Free radicals are highly reactive molecules or chemical species containing one or more unpaired electrons in their outermost shell. They react quickly with nearest stable molecule to capture electron, in need to gain stability. They promote beneficial oxidation that produces energy and kill bacterial invaders. If free radicals are at reasonable levels, human body produces enzymes to combat them and is helpful in immune system and anti bacterial cell activity. A single free radical can cause damage to millions of other molecules in body from functioning properly.

This molecular destruction is continually occurring in our body. Although antioxidants are a result of breathing but these free radicals attack us from many different sources every day. They are: Alcohol, Tobacco, Drugs, Smoked and Barbecued Foods, Harmful Chemicals and Pesticides, and Food Additives.

Antioxidant Defense:

Antioxidant defense system (ADS) against oxidative stress is composed of several lines and antioxidants are classified into four categories based on their function"

First: Preventive antioxidants which suppress formation of free radicals.

Second: Radical scavenging antioxidants which suppress chain initiation and breaking chain propagation reactions.

Third: - Repair and de novo antioxidants.

Fourth: Adaption where the signal for the production and actions of free radicals induces formation and transport of the appropriate antioxidant to the right site.

The Antioxidant Process

Antioxidants block process of oxidation by neutralizing free radicals. In doing so, antioxidants themselves become oxidized.

The two ways by which they act are-

Chain-breaking

When a free radical releases or steals an electron, a second radical is formed. This molecule then turns around and does same thing to a third molecule, continuing to generate more unstable products. The process continues until termination occurs - either radical is stabilized by a chain-breaking antioxidant such as beta carotene and vitamins C and E, or it simply decays into a harmless product.

Preventive Antioxidant

Antioxidant enzymes like superoxide dismutase, catalase and glutathione peroxidase prevent oxidation by reducing rate of chain initiation. They can also prevent oxidation by stabilizing transition metal radicals such as copper and iron.

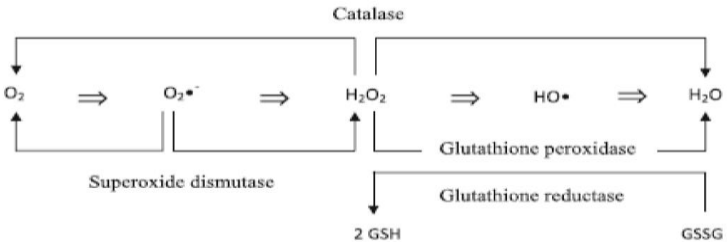

Figure 1 MECHANISM OF ANTIOXIDANT FUNCTION