Health Biotechnology and Biopharma (2018), 2(2): 14-18

Minireview Article

Plant antioxidants and their evaluation

Mansureh Ghavam*[1]

[1] Department of Range and Watershed Management, Faculty of Natural Resources and Earth Sciences, University of Kashan, Kashan, Iran

***Corresponding author:**.Mansureh Ghavam, Department of Range and Watershed Management, Faculty of Natural Resources and Earth Sciences, University of Kashan, Kashan, Iran. Email: mghvam@kashanu.ac.ir*

DOI: 10.22034/HBB.2018.16

Received: September 30, 2018; **Accepted:** October 1, 2018

ABSTRACT

Antioxidants are substances at low concentrations and with a special mechanism which slow down or stop oxidation processes. Antioxidants are divided into two synthetic and natural categories. In this study, plants are the most important sources of antioxidants that could protect cells from oxidative damage which can lead to cell death and tissue damage. Antioxidant enzymes increase the potency of antioxidants and reduce the incidence of certain diseases, such as cancer, cardiovascular disease and stroke. There are two general groups for determining the antioxidant activity. These methods including the method for the hydrogen atom transfer reaction mechanism and method for the hydrogen-electron-single-electron transport reaction mechanism.

***Keywords*:** Plants, free radicals, oxidative damage

INTRODUCTION

Antioxidants are substances at low concentration to slow down or stop oxidation processes [1]. These materials participate in various reactions to slow down the release stage and combine radicals [2].

In fact, antioxidants are compounds that prevent the production of radicals and neutralize free radicals to inhibit oxidation. In this way oxidative damage caused by the imbalance of these active particles with antioxidants prevents. Anti-oxidants have a high diversity, a group soluble in fat and a

group soluble in water. Antioxidants are divided into natural and synthetic groups [3].

Antioxidants are divided into two synthetic and natural categories. During the evolution of biological systems, the body has been developed to maintain balance between free radicals and oxidative stress. The antioxidant system is divided into two large enzymatic and non-enzymatic groups.

The enzymatic antioxidants in the endogenous group and non-enzymatic antioxidants are in the exogenous antioxidants category. The antioxidant defense system contains enzymatic agents such as catalase, superoxide dismotor and glutathione peroxidase which neutralize the radicals of hydrogen peroxide, superoxide and organic peroxides within the cells. Enzyme antioxidants play a protective role. Non-enzymatic antioxidants include phenolic acids, polyphenols, flavonoids, vitamin E, carotenoids, ureic acid, vitamin C, glutathione and vitamin K. There are various antioxidants in the plasma which the immune system alone does not have the ability to eliminate free radicals due to environmental and internal stress conditions. Therefore, the need to provide antioxidants from external sources is necessary [4].

According to this research, plants are the most important sources of antioxidants that could protect cells from oxidative damage. Natural antioxidants, in addition to activate antioxidant enzymes, also increase the potency of antioxidants and reduce the incidence of certain diseases, such as cancer, cardiovascular disease and stroke. Secondary metabolites, such as phenol, flavonoids, are present in different parts of the plant, such as leaves, fruits, seeds, roots and skin which are important sources of antioxidant production. Phenols are secondary metabolites and important plant compounds that are commonly found in response to environmental stress. These compositions are made from aromatic groups. The ability of phenols to neutralize free radicals is related to the presence of their hydroxyl group, which, as a carrier of hydrogen or electron.

Methods for measuring antioxidant activity

Measurement based on hydrogen atom transfer

Antioxidants are oxidizing molecules which participate in the reaction such as an antioxidant or a susceptible candidate for radical free radicalization. In fact, this measurement is based on competitive responses, which is obtained from the speed curve. In this assessment, both anti-oxidants and the active ingredient react with free radicals. Antioxidant activity is determined in the presence and absence of antioxidants.

This measurements are obtained by comparing their reaction speed with the fluorescence curve and calculating the area under the curve.

Measurement based on the electron transfer

This reaction detects the antioxidant depletion capacity by changing the color of the sample or the oxidant. The color change is proportional to the antioxidant concentration. In general, this method is based on the electron transfer between the two combinations of antioxidants and oxidants. The most important methods for assessing antioxidant capacity based on electron transfer.

There are two general groups for determining the antioxidant activity, and most of them have complementary effects. These methods are based on the interaction between reactive molecules with metal ions and their effects have been investigated by chemical measurements. The DPPH test is the convenient, precise and easy method for determining the antioxidant properties of fruit juices and extracts. The DPPH method is a simple and easy way to determine the antioxidant capacity in fruits and vegetables or their extracts. The TRAP method and the TEAC method are not specific to a particular sample and are widely used.

DPPH radical trapping capacity measurement.

DPPH is a stable free radical with an unpaired electron on one of the nitrogen bridge atoms. DPPH radical inhibition is the basis of antioxidant capacity. This method was first performed in 1958 by Blues, and was used as a common method for evaluating the potential for free radical control of antioxidants. The DPPH molecule is a stable free radical of nitrogen, chromogen and lipophilic, and can initiate auto-oxidation chain reactions. This radical reacts directly with antioxidants due to the presence of a single electron and is restored by receiving a hydrogen atom. DPPH is a stable radical with a methanol solution in violet that exhibits a maximum absorption at 517 nm. The basis of this approach is that the DPPH radical acts as an electron acceptor from a donor molecule, such as antioxidants, and DPPH converts to DPPH2. In this case, the violet color of the medium becomes yellow and the intensity of absorption decreases [3]. Antioxidant strength depends on the percentage of this color change. By observing the change in the absorption of the tested specimens, the ability of different molecules as a radical inhibitor is measured. The concentration of antioxidants, which eliminates 50 % of the radicals, is defined by IC50. The IC50 has an antioxidant

effect on photo ratio and with a direct inhibition ratio.

Measurement of the amount of total phenol with folin cyclotomy reagent (FCR)

This method was used to analyze proteins. Subsequently, in this method determine the amount of total phenol in wine. Gradually, this method became more useful. By this method, we could measure the capacity reduction of the sample. There is often a direct correlation between the total amount of phenols and the level of antioxidants activity. Folicin is a yellow solution of sodium molybdate, sodium tungstate, phosphoric acid (85 %), concentrated chloride, lithium sulfate and water. The presence of regenerating agents in the environment creates green color. The exact chemical nature of the FCR reaction is unknown. However, it is believed to contain heteropolymer. Increasing the absorption intensity of this reaction takes place at 760 nm and after 2 h. Reagent folin ciocaltivo is a non-specific reagent. Phenolic compounds react in a basic condition with a sodium carbonate solution at pH about 10. In addition, the phenolic proton is converted to anion phonolite that this anion inhibits the colecular folin rejection.

CONCLUSION

Nowadays, thousands of secondary plant metabolites are successfully used to treat various diseases. The use of medicinal herbs in many countries is increasing that 35 % of the medications are containing natural compounds. Since plants are the source of natural antioxidants and with their help to protect cells from oxidative stress, extensive research is carried out on plant extracts, rather than on products with high antioxidant activity. Two methods of DPPH and the use of total phenol content are suitable and effective in identifying the antioxidant properties of plants.

REFERENCES

[1] Shahidi F. Natural antioxidants: an overview, In: Natural antioxidants, chemistry, health effects and applications. AOCS Press Champaign, Illinois, USA, 1997, 1-10.

[2]. Quaite FE, Sutherland BM, Sutherland JC. Action spectrum for DNA damage in alfalfa lowers predicted impact of ozone depletion. *Nature*, 1992; 358: 576-78.

[3]. Tosserams M, Pais de Sa A, Rozema J. The effect of solar UV radiation on four plant species occurring in coastal grassland vegetation in the Netherlands. *Physiologia Plantarum*, 1996; 97(4): 731-39.

[4]. Smirnoff N, Wheelev GL. Ascorbic acid in plants: Biosyntesis and function. *Critical Rev in Plant Sci,* 2000; 19(4): 267-90.