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FLUCTUATION OF IRON CONTENT IN SPINACH PLANTS STIMULATED BY MAGNETIC NANO PARTICLES

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ABSTRACT

Iron is very useful for the human, especially for people with anemia. Irons are found mainly in the green vegetables such as spinach plants. We known, the iron content in the spinach plants can be determined using magnetic susceptibility measurement. Higher magnetic susceptibility values means that the spinach plant has high level of iron content. In this work, we study the effect of the magnetic nano particle to enhance the iron content on the spinach plants. The stimulation of the magnetic nano particles has been done by the provision of magnetic nano particles in growing media. The magnetic nano particle was injected to the growing media every week and then the sample plants were characterized. Magnetic susceptibility and the amount of iron that is absorbed in the plants were measuring by susceptibility-meter and atomic absorption spectroscopy, respectively. First week after the spinach plants was injected with magnetic nano particles, magnetic susceptibility value was increases. Second week after the spinach plants was injected, magnetic susceptibility value was decreases. The declining of the magnetic susceptibility can be explained that spinach plants continue to grow in two week so the magnetic susceptibility measured was smaller. However, magnetic susceptibility value was increasing again when the spinach plants was injected with the magnetic nano particles. Based on that, we can conclude the magnetic nano particle can be used to increase the iron content on the spinach plants.

Key Word: iron content, spinach plant, nano-sized magnetic

INTRODUCTION

Iron in the human body have a very important role because red blood cells have a tremendously important function in the body is also built with the iron. Lack of iron in the human body can cause various health problems such as anemia, decreased vitality and so on. In healthy conditions, iron is much needed by the pregnant mother or the child in infancy. Iron deficiency in children's will lead to an inability to learn and lower IQ (Ani, 2012). Health consultants usually advised to get enough iron, it can be done by consuming a multivitamin, beans and green vegetables such as spinach.

The existence of iron in spinach plants an important topic to be studied in physics. This is because iron with nickel and cobalt have magnetic properties that really stands out compared to other elements. It's happened because the iron atoms there are a number of valence electrons, which produces a magnetic dipole moment as agents of the emergence of the magnetic properties of ferrous metals. Due to its fact, it is not surprising that the presence of iron in spinach vegetables can be detected by measuring the magnetic properties of magnetic susceptibility. Thus, measurement of magnetic susceptibility can be viewed as a reliable method to predict the number of qualitative vegetable iron in spinach.

A review symptom of magnetism on the plant is still considered relatively new. However, this study is very interesting to learn that the iron has a benefit in the body. Aji et al. (2005) was conducted measurement of susceptibility magnetic on spinach plants pest in some areas of potential exposure to pollutants at Semarang city. The result show that spinach is an example of a positive has susceptibility magnetic which means there is an iron content in the samples. Subber et al. (2012) was investigated the effect of magnetic fields on Zey mays plant grown. Long radicals and protein percentage are increased significantly formed with the long time of a magnetic field was applied. Application of the magnetic field on the plant Triticum aestivum also affect in the process germanisasi and the significant effect on the protein radical formation (Jabail et al., 2013). Flores et al was studied the effect of magnetic fields on the process germanisasi on the herbs plant such as officinalis salvia

and calendula officinalis. Specific observations on plant roots of Triticum aestivum shows that the application of magnetic fields during the growth process can be caused the plant root are diamagnetik (Uelas et al., 2004). Meanwhile, the magnetic nano particles stimulation is also done in suspension of Tobacco BY-2 cells (Krystofova et al., 2013). This study shows that magnetic nano particles stimulation affect on the antioxidant elements contained in BY-2 cells. Cifuentes et al. (2010) was also studied the absorption and translocation of magnetic nano particles in the roots of plants.

In this paper, we report the fluctuation of iron content in spinach plants stimulated by magnetic nano particles based on the synthesis of iron sand. The iron content was determined through the measurement of the amount of iron that is absorbed in the plant and magnetic susceptibility value. The measurement has been done using atomic absorption spectroscopy and susceptibility-meter.

METHODS

Spinach plants samples was grown in the green house with dimension 8 x 8 x 4 m. The roof of the green house was prepared by UV plastics and the green house walls made from black paranet. First, the spinach seeds are sown in the media that made of a mixture of soil and compost. Spinach is growing in about 3 days. Spinach plants aged 10 days and then transferred to the medium which is made of ground rice husk fuel. After one or two days, the spinach plant has been growing steadily. Furthermore, the magnetic nano particles were resulted from the synthesis of iron sand was injected to the media growing. Injection of magnetic nano particles solution was performed regularly every 3 days. Spinach plant samples picking is done every week. Spinach plant sample was characterized by susceptibility-meter and atomic absorption spectroscopy to determine magnetic susceptibility and the amount of iron that is absorbed in the plant, respectively.

RESULT AND EXPLANATION

Green House

In this research, the spinach plants grown under control by green house in size 8 x 8 x 4 m. The roof of the green house was prepared by UV plastics to absorb 20% sunlight. The green house walls made from black paranet, its can absorb 45% sunlight passing through in green house. In addition to control the heat and the intensity of sunlight entering the greenhouse is also intended to prevent of the insects that would damage the crop. By using green house, the use of insecticides to kill the pest is not required. So, the vegetables produces was avoided by insecticide residues and healthier. Figure 1 shows the green house and the spinach plants samples.

Spinach Plants Product

The spinach plants can be grown in the hot conditions that provided a considerable amount of water needed adequate. The spinach cultivation begins with the sowing of ore to the growing media made from a compound of soil and compost. ore spinach grown faster that germinate in about 3 days. Furthermore, the sprouts spinach moved to the growing media at the age of 10 days. Growing media here are planting rice husk fuel with given water flow. one or two days after planting and the spinach plants growing is stable, then the growing media was injected with an aqueous solution of magnetic nano particle was resulted from synthesis of iron sand. Magnetic nano particle solution injection was performed regularly every 3 days and Sprinkling with fresh water every 2 days.

Magnetic nano particles stimulation utilization solution in this study were able to produce vegetables containing iron, Fe, and relatively higher than similar products in the market. Iron content in this research was around 9897 mg / 100 g, while the Fe content of the product in the market about 3.3 mg / 100 g. It can be said that the additional of magnetic nano particle in the growing media of spinach plants can be increased the Fe content higher than existing similar products in the market. In addition, the product of high abundance of iron in spinach plants can also be obtained either by planting flat and level planting as shown in Figure 2. The position of the plant does not affect to the distribution of magnetic nano particle was injected into the planting medium, but the lighting and water content which can affect the distribution of magnetic nano particles on spinach plants.

Fluctuations of the Fe content in spinach plants are stimulated with magnetic nano particles was occured when magnetic nano particles stimulation discontinued in quite a long time around 15 days. Fe content in spinach plant products become relatively dropped to 5,142 mg / 100 g when the stimulation was stopped. However, Fe contents was increased to 5.672 mg/100 gr when the magnetic nano particles stimulation given back. This indicates that the periodicities of giving injections into the planting medium will determine the iron content in spinach plant products. Based on the above symptoms can be assumed that method was effectively to produce spinach plants with a high iron content by stimulating the growing media with magnetic nano particles with

periodic short intervals and concentrations increases gradually in accordance to the size of the plant.

CONCLUSION

Preliminary research on magnetic nano particles stimulation at spinach plants to improve the iron content in spinach plants has been done. Spinach plants products which are stimulated with magnetic nano particles on planting medium have high iron content than similar products on the market. Iron content on the spinach plants products was stimulated with magnetic nano particles and spinach plants in the market are 9.897 mg/100 gr and 3.3 mg/100 gr, respectively. Periodicities on the stimulasion of magnetic nano particles also influence the content of iron in the spinach plants products. Fluctuation on the iron content in the spinach plants products depend on the periodically on stimulation of magnetic nano particles. The method method was effectively to produce spinach plants with a high iron content by stimulating the growing media with magnetic nano particles with periodic short intervals and concentrations increases gradually in accordance to the size of the plant.

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