The Germination Variations in Fleawort *(Plantago psyllium L.)* by Nano-Particle

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**Abstract**—In order to the effect of nanoparticles on germination variations in fleawort *(Plantago psyllium L.)*, this experiment was conducted in 2011 at Islamic Azad University Shahr-e-Qods Branch, Tehran, Iran by a completely randomized design with four replications. The factor studied included use of TiO$_2$ (Control, 0.02 and 0.03 percentage). The results showed that the effect of TiO$_2$ nanoparticles was significant on germination percentage in P < 0.01. Mean comparison showed that the highest germination percentage (84%) was achieved by use of 0.03 percentage of TiO$_2$. The results of this experiment showed that the use of TiO$_2$ nanoparticles can increased the germination in fleawort *(Plantago psyllium L.)*.

**Keywords**—Nanoparticles, germination, fleawort *(Plantago psyllium L.)*.

**I. INTRODUCTION**

**NANOTECHNOLOGY** collectively describes technology and science involving nano scale particles (nanoparticles) that increases the scope of investigating and regulating the interplay at cell level between synthetic materials and biological systems. It is commonly seen growing in Southern Europe, as well as in Northern Africa and in Southern Asia. It is also observed in most parts of New Zealand, America and Australia. The seeds and the leaves of the *Plantago psyllium* plant are used in preparing medicinal preparations. *Plantago psyllium* seed husks dilate and become mucilaginous when wet, and is a common home remedy as a laxative [1].

*Plantago* is a genus of about 200 species of small, inconspicuous plants commonly called plantains. They share this name with the very dissimilar plantain, a kind of banana. Most are herbaceous plants, though a few are subshrubs growing to 60 cm (23.5 in) tall. *Plantago psyllium* is administered in the form of powders and capsules. In some medicinal preparations it is also used in combination with digestive regulators such as bifidus. However, it is important to drink plenty of water or fluid when consuming *psyllium*.

The leaves are sessile, but have a narrow part near the stem which is a pseudo-petiole. They have three or five parallel veins that diverge in the wider part of the leaf. Leaves are broad or narrow, depending on the species. The inflorescences are borne on stalks typically 5–40 cm (2.25-15.75 in) tall, and can be a short cone or a long spike, with numerous tiny wind-pollinated flowers. *Plantago* has been recommended as a laxative for centuries and recent research has shown its efficacy in combating constipation. The seeds of the *psyllium* plant possess 10-30 percent mucilage.

The gelatinous mass formed after the seeds have been soaked in water, causes the feces in the large intestine to get hydrated and soft. Hence, the overall volume induces a reflex contraction of the walls of the bowel, accompanied by emptying without any pain or bleeding.

Nutritionists believe that *psyllium* is beneficial for people who are dieting in order to lose weight. Some medical studies even show how *psyllium* seeds affect the intake of fat, thus making *psyllium* a strong prospect in diets meant for heavy and obese people. Seeds of *Plantago psyllium* are used by herbalists to normalize bowel movements and relieve diarrhea. The herb is also used to treat enteric disorders like inflammatory bowel disease and dysentery, bladder disorders, rheumatoid arthritis, ulcerations, and urinary tract infections.

Traditionally *psyllium* was as a treatment for cough and in some tropical countries a preparation of *psyllium* sees is still used to treat hemorrhoids, eruptions of the skin, and insect bites and stings [2].

TiO$_2$ nanoparticles, catalytic activity is dramatically increased at particles sizes below 20 nm. Unfortunately few synthesis techniques can reproducibly produce particles below 10 nm, limiting the range of currently studied particle sizes.

The use of combustion flame synthesis has shown the promise of producing quality particles in the desired size range while extensive studies have been conducted on flame-synthesized particles larger than 10nm. Optimization of the process parameters can yield particles as small as 3nm [3].

Titanium dioxide occurs in nature as well-known minerals rutile, anatase and brookite, and additionally as two high pressure forms, a monoclinic baddeleyite-like form and an orthorhombic α-PbO$_2$-like form, both found recently at the Ries crater in Bavaria. The most common form is rutile, which is also the equilibrium phase at all temperatures.

The metastable anatase and brookite phases both convert to rutile upon heating. Rutile, anatase and brookite all contain six coordinated titanium [4].
This experiment was conducted to study the effect of TiO2 nanoparticles on germination variation in fleawort (Plantago psyllium L.) in 2011 at Iran.

II. MATERIAL AND METHODS

In order to study the effect of TiO2 nanoparticles on germination variation in fleawort (Plantago psyllium L.), this experiment was conducted in 2011 at Islamic Azad University Shahr-e-Qods Branch by a completely randomized design with four replications.

The factor studied included use of TiO2 (Control, 0.02 and 0.03 percentage). Seeds were put in disinfected Petri dish and each Petri dish contained 100 seeds. Four replicates of 100 seeds were put between double layers. All of the Petri dish irrigated and germinated at 20 ± 1°C for 15 days.

Germination percentage was calculated with the following formula:

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\text{Germination percentage} = \frac{\text{Number of germinated seeds}}{\text{Number of total seeds}} \times 100
\]

Data analyses were performed using the Spss statistical software and graph pointed by excel software for compression with control treatment.

III. RESULTS AND DISCUSSION

The results showed that the effect of TiO2 nanoparticles was significant on germination percentage in P ≤ 0.01.

Mean comparison showed that the highest germination percentage (84%) was achieved by use of 0.03 percentage of TiO2.

The results of this experiment showed that the use of TiO2 nanoparticles can increase the germination in fleawort (Plantago psyllium L.).

Priming enhanced germination, better establishment and increased yields in a range of crops in many diverse environments [5].

It has been long known that one of the main merits of priming treatments is to increase germination and emergence rate [6].

However, the question arises whether rapid radicle protrusion is always reflected in rapid seedling emergence. Reference [7] proposed that emergence losses in the soil are not generally due to germination failure, but failure of seedlings to grow and emerge above soil surface.

Increased emergence rate due to seed priming may be due to increased rate of cell division in the root tips of seedlings from primed seeds as reported in tomato [8].

Increased shoot and root length may be due to early emergence induced by priming treatment as compared to unprimed seeds.

Reference [9] presented the same results by observing that priming of the pepper seeds significantly improved root length. Stress tolerance due to pre-treatment of seeds suggests that these molecules trigger the expression of the potential to tolerate stress rather than having any direct effect as a protectant [10].

It is well established that a vigourous seed can produce a better seedling under stress conditions than the non-vigourous one.

All the priming treatments showed improved germination as compared to non-primed seeds which were due to increased shoot and root length of seedlings from primed seeds and so much more vigourous than from un-primed seeds.

Reference [11] also suggested that priming treatments improves the vigour of the seeds.

Primed seeds usually exhibit the increased germination rate, reduced mean germination time, greater germination uniformity and some time greater total germination percentage in many plant species [12].

These were consistent with the Reference [13] findings on rice seedling establishment in flooded soil and Hampton and Reference [14] view that high vigour seed lot would perform better in field performance under environmentally stressed seed bed conditions than low-vigour seed lots.

Primed seeds might have better plasma membrane structure by slow hydration [15].

Priming also causes to reduce the adherence of seed coat due to imbibition, which may permit to emerge out radicle without resistance as Reference [16] reported that the priming minimizes seed coat adherence during emergence of muskmelon seeds.

Rapid embryo growth resulted when the obstacle to germination was removed.

These changes include macromolecular synthesis, several enzyme activities, increase in germinating power and vigour and overcoming of dormancy.

![Fig. 1 Compression of control treatment with 0.02 % TiO2](image-url)
Fig. 2 Compression of Control treatment with 0.03 % TiO2

Fig. 3 Compression of 0.02 % TiO2 treatment with 0.03 % TiO2

Fig. 4 Effect of TiO2 nanoparticles on germination variations

REFERENCES


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