Effect of TiO$_2$ Nanoparticles Spraying on Calendula (Calendula Officinalis L.)

Malehe Gholampour Rasekh, Payam Moaveni, Hossein Aliabadi Farahani and Kasra Maroufi

$^1$MSc student in Agronomy, Islamic Azad University, Karaj Branch, Tehran, Iran.
$^2$Islamic Azad University, Shahr-e-Qods Branch, Tehran, Iran.
$^3$Young Researchers Club, Shahr-e-Qods Branch, Islamic Azad University, Tehran, Iran.

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ABSTRACT

An experiment was carried out using a factorial on the basis of completely randomized block design. The factor of studied included of TiO$_2$ Nano particles spraying affected on calendula (Calendula officinalis L.). The factor of study included spraying in five levels of Tio2 (control, Dioxide Tio2, 0.01, 0.02, and 0.03 percentage) in 4 leaves growth stages. The characters measured were: SOD, CAT and MDA. The results showed that effect of TiO$_2$ Nano particles spraying significant on SOD, CAT and MDA in $P < 0.05$ Mean comparison showed that the highest SOD (1208.75 mol/g), CAT (283.75 mol/g) were achieved by Nano particles 0.03 percentage but Mean comparison showed that the highest MDA (64.05 mol/g) were achieved by Dioxide TiO$_2$ Nano particles.

Key words: Nano particle Tio$_2$, SOD, CAT, SOD and calendula.

Introduction

Calendula is one of the most known and used medicinal plants, that is widely cultivated both for obtaining extracts used in phytotherapy and ornamental purposes. The chemical composition of the species and of its varieties is very complex. It is known that the number and the lifetime of charge carriers on the surface of the nanoparticles are crucial for initiating and maintaining the photocatalytic process. The number and lifetime of free electrons and holes are determined by the competition between recombination and trapping of carriers as well as that between trapped carriers and the interfacial charge transfer [1]. In addition to the large surface area for maximum contact between charge carriers and pollutant, TiO$_2$ nanoparticles with the appropriate size range can also make the interfacial transfer of charge carriers easier and further reduce the recombination rate and increase the lifetime. Outside of that size window, volume recombination and surface recombination occurs for larger particles and very fine particles, respectively. The dye-sensitized TiO$_2$ solar cells are inexpensive and have high photon to electron conversion efficiency [2]. TiO$_2$ is probably the most investigated photocatalyst system and has been found to be capable of decomposing a wide variety of organics [1,8] it is becoming a promising material for lithium rechargeable batteries [3]. These structures can be obtained from titania nanodisperse hydrosols. It is necessary to prepare sols of uniform (monodisperse) nanocrystals and then to conduct sol-gel-xerogel transformations under the control of structural changes. The fractionation method has been developed, allowing one to isolate uniform titania nanocrystals from hydrosols [4,5]. Since the photocatalytic activity of TiO$_2$ is influenced by the crystal size, crystal structure, crystallinity, and surface hydroxylation, the synthesis of phase pure nanocrystalline anatase TiO$_2$ is challenging. This experiment was conducted to effect of TiO$_2$ nanoparticles spraying on calendula (Calendula officinalis L.).
Materials and methods

This experiment was carried out using a factorial on the basis complete randomized block design with four replications in a year planting (2010-2011) at Islamic Azad University Shahr-e-Qods Branch, Tehran, Iran. The factor of study included spraying in five levels of TiO2 (control, Dioxide TiO2, 0.01, 0.02, and 0.03 percentage) in 4 leaves growth stages on calendula (Calendula officinalis L.). The characters measured were: SOD, CAT and MDA.

Statistics analysis:

Data were subjected to analysis of variance (ANOVA) using Statistical Analysis System (Spss) computer software at P < 0.05.

Results and discussion

SOD:

The results showed that the effect of TiO2 Nano particles was significant on SOD in P ≤ 0.05. The highest SOD (1208.75 mol/g) was achieved by Nano particles 0.03 percentage and lowest SOD (715.00 mol/g) was achieved by control treatment (Table 1, Fig 1).

CAT:

The results showed that the effect of TiO2 Nano particles was significant on CAT in P ≤ 0.05. The highest CAT (283.75 mol/g) were achieved by Nano particles 0.03 percentage and lowest CAT (183.50 mol/g) was achieved by Dioxide TiO2 Nano particles (Table 1, Fig 2).

MDA:

The results showed that the effect of TiO2 Nano particles was significant on MDA in P ≤ 0.05. The highest MDA (64.05 mol/g) were achieved by Dioxide TiO2 Nano particles and lowest MDA (28.70 mol/g) was achieved by Nano particles 0.03 percentage (Table 1, Fig 3).

Due to the strong confinement effects, the electrical and optical properties of nanocrystalline thin films are varying significantly with grain size. This tuned physical property of nanocrystalline thin films makes them an important category material that can find potential applications in photovoltaic devices [6]. The development of nanotechnology for the synthesis of nanomaterials is providing unprecedented opportunities to deal with emerging environmental problems associated with water contamination along with worldwide energy-related concerns [7]. Degradation might further the release of nanoparticles. When stability is important to nanocomposite design, nanoparticles may still be released.

Table 1: Means Comparison

<table>
<thead>
<tr>
<th>Treatment</th>
<th>SOD</th>
<th>CAT</th>
<th>MDA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>715.00</td>
<td>188.00</td>
<td>63.12</td>
</tr>
<tr>
<td>TiO2 Nano particles (0.01%)</td>
<td>939.75</td>
<td>249.50</td>
<td>44.55</td>
</tr>
<tr>
<td>TiO2 Nano particles (0.02%)</td>
<td>935.75</td>
<td>243.50</td>
<td>41.47</td>
</tr>
<tr>
<td>TiO2 Nano particles (0.03%)</td>
<td>1208.75</td>
<td>283.75</td>
<td>28.70</td>
</tr>
<tr>
<td>Dioxide TiO2 Nano particles</td>
<td>715.50</td>
<td>183.50</td>
<td>64.05</td>
</tr>
</tbody>
</table>

Means within the same column and factors, followed by the same letter are not significantly difference.

Fig. 1: Effect of Nano particles TiO2 spraying on SOD in calendula.
Fig. 2: Effect of Nano particles TiO$_2$ spraying on CAT in calendula.

Fig. 3: Effect of Nano particles TiO$_2$ spraying on MDA in calendula.

References