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# Synthesis of Zinc Oxide Nanoparticles and its Catalytic Activity and Antibacterial Activity for Degradation of Soaked Green Peas Food Adulterated Dye

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**ABSTRACT**

Artificial green color (Malachite Green) in vegetables causes the Food adulteration. It decreases the quality and is highly hazardous to human health. An attempt is made to remove the Malachite Green with nanoparticles of ZnO NPs. Its catalytic activity and antibacterial activity reduces the Malachite Green in vegetables. Nano ZnO NPs particles were prepared, added to green peas . The Experiment was done by collecting samples of green peas and washing four times by changing washing time . pH and total dissolved substance were estimated in each wash. All samples of soaked green peas were tested under UV spectroscopy. Therefore, the fall of Malachite Green is where each sample was studied by analyzing the absorption of ultraviolet radiation passing through the sample. Further, the antimicrobial susceptibility test was done for ZnO NPs. Thus, concentrations of microbial organisms are estimated at 5000 mg/ml. And, it is found that the nano ZnO NPs particles have effectively removed the Malachite Green from vegetables.

Keywords: Zinc Oxide, Malachite Green, Fluorescence, and Absorbance

## 1. INTRODUCTION

India has the most popular marketing country in all over the world. So, consumers are the very midpoint of our economics. Foods are very important to live in. The incoming people are not balanced with producing vegetables and other food products.

The middle brokers thought that they would gain more money with less investment. So, they used adulterants in the vegetables and other food items. Usually, adulterants may be toxic and can affect health. Food adulteration can lower the quality of food to increase its quantity [1]-[3]. In this soaked green pea's food contamination of MG Dye. This MG dye highly solubility capacity in water and highly toxic in human beings. Such a type of highly toxic, water-soluble dye cannot easily be removed from water. Being difficult to decompose biologically, dyes may have negative effects on human health even at low concentrations [4],[5]. Also, some countries have been banned but it is still

used by some people due to the attraction of color. It is essential to eliminate MG from soaked green pea's food adulterants before its discharge due to its toxic potential [6]. Nowadays many analytical techniques are proposed by reducing the dye like oxidation [7], [8], adsorption [9], photo catalytic and SERS method [10],[11], etc. Photocatalytic material should be used to be nonhazardous, cheep, and highly effective. ZnO NPs have been a good alternative compared to other metal oxide nanoparticles due to its higher efficiency [12],[13]. This problem can be overcome by using ZnO NPs and also has proved against antibacterial activity. This was a synthesized chemical precipitation method, and biodegradable, cheap, low toxic, and had no advance effect on human beings.

**1.1 Types of Adulteration**

There are three types of adulteration found in the world.

**1.1.1 Intentional Adulterants**

The adulterant could be physical or biological property like sand, stone, chalk powder, water, oil, and coal tars.

**1.1.2. Metallic Contamination**

The adulterant includes arsenic from pesticide, Lead from water, Mercury from the plant effluent of chemical industries, etc.

**1.1.3 Incidental Adulterants**

These are pesticide residues and larvae in foods.

**1.1.4 Microbial Organism**

This type of contamination by microorganisms due to food processing techniques like packing, processing, handling, and preparation [14],[15].

Food and Drug administration defined the adulterant as [16],

1. An adulterant can be injurious to health
2. Cheaper quality item added to the food
3. Lowering the quality of the food
4. The substance can increase the weight of the standards
5. To make it as a valuable food to see the eye.

Usually, adulterants can affect immediately like diarrhea, dysentery, and vomiting [17],[18].

Besides too long-term effects like cancer, liver failure, kidney failure, and the risk of heart. Yet we have better education and better knowledge will easily affect the above disease [19],[20]. The present study aims ~~and~~ to create the minimum awareness to our people to buy and cook-soaked green pea in day-to-day life. Thereby I collected soaked green peas in the Dharmapuri market then washed them 5 times. The washed water and washed water addition of ZnO NPs (malachite green dye adulterated) examined UV and Fluorescence spectroscopy. Finally, the concentration of the malachite green dye-soaked green pea and dry green pea have been compared.

## 2. MATERIALS AND METHODS

Zinc Nitrate (> 98%) and peas are collected in the local market of Salem. UV-Visible absorption spectrophotometer JASCO-V-750, Fluorescence spectrophotometer JASCO-FP-8300.

**2.1 Preparation of ZnO Nanoparticles**

Zinc nitrate was dissolved in double distilled water while constantly stirring in two hours. The obtained precipitate was washed several times using double distilled water. The resulting solution was filtered and dried to calcinated at 600 $^0$C for 30 min.

**2.2 Experimental Design**

In this work comparison of soaked peas water and soaked peas water with the addition of ZnONPs in different time washings namely dry, wash-1, wash-2, wash-3, and wash-4.

**2.3 Washed Water Sample**

Samples of soaked green pea 100g washed with various 100 ml of distilled water then it Named as wash-1, wash-2, wash-3, and wash-4, and at the same time 10 mg ZnO NPs add each washing-soaked green pea.

**2.4 Sampling: Sampling Unit**

To study-soaked green pea dye adulteration, we considered Dharmapuri local market as a sample unit.

### 2.5 Sample Quantity

Most of the consumers buying daily usage of green pea were 100 g per day. So, 100 g of green pea samples have been for our study. The research article study is to create awareness of consumers towards food adulteration. They are by people who should know the quality of food and also get awareness of the cooking methods in vegetables.

### 2.6 Screening of Antibacterial Activity

Aspergillus Niger & Escherichia coli bacterial strains were used to investigate. The bacterial cultures were obtained from Microbial Type Culture Collection (MTCC), Institute of Microbial Technology, Chandigarh, India. The younger bacterial cultures were prepared for antibacterial activity.

### 2.6.1 Preparation of Inoculums

The standard stock cultures were maintained with nutrient agar at the temperatures of 4C. The test cultures of the experiment were prepared from the stock cultures in the test tube of Muller- Hinton younger culture. The young culture was incubated for 24 hours at various temperatures (25°C and 37°C). The cultures were diluted with fresh Muller-Hinton broth to achieve optical densities corresponding to 2.0 ×106 colony forming units (CFU/ml) for bacteria.

## 3. RESULTS AND DISCUSSION

### 3.1 Collection of Washed Water

Soaked green peas were washed 4 times with every 100 ml of distilled water. While washing green pea with distilled water we observed green color water but this color concentration was decreased when washing continuously the same quantity of water. The collected water samples were studied under UV and Fluorescence spectroscopy method was used to check their concentration of malachite green dye diluted solution.

### 3.2 pH and TDS Analysis

pH was analyzed by the Deluxe pH meter model ME 963P. The pH and TDS values are given in the Table: 1 and Figure 1&2.The PH and TDS values increase from soaked green pea water to additions of ZnONPs Soaked green pea water. It is indicated ZnONPs are mixed with soaked green pea water.

Table1. pH and TDS parameters for soaked green pea water with and without ZnO nanoparticles

| S.No | Sample Name | Soaked Green Pea Water | | Additions of ZnO Nps Soaked Green Pea Water | |
|---|---|---|---|---|---|
| | | pH | TDS | pH | TDS |
| 1 | Dry | 7.00 | 86.95 | 7.25 | 88.46 |
| 2 | Wash 1 | 7.10 | 82.35 | 7.40 | 83.33 |
| 3 | Wash 2 | 7.35 | 78.57 | 7.50 | 80.00 |
| 4 | Wash 3 | 7.87 | 66.66 | 7.54 | 75.00 |
| 5 | Wash 4 | 7.97 | 57.14 | 7.57 | 70.00 |

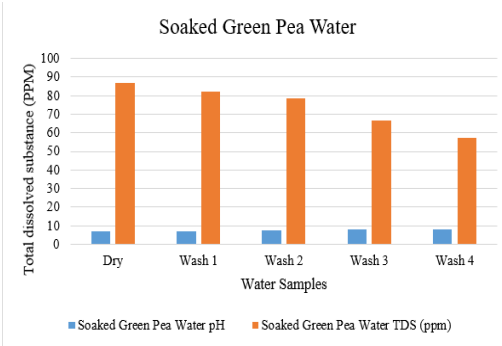


Fig .1 Soaked green pea water

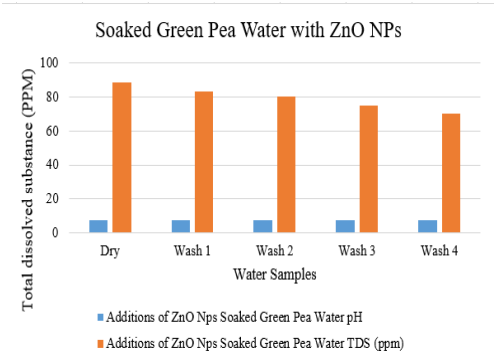


Fig. 2 Additions of ZnO NPs Soaked green pea water

### 3.3 UV Spectroscopy:

Selection of the detection wavelength: Both washed water samples of green pea and ZnO NPs are mixed with soaked green pea water was recorded using a UV-Visible absorption spectrophotometer

JASCO-V-750 in the range of 200 to 800 nm. A peak prominent absorption was observed and found it as 625 nm in the spectrum. As malachite green is a greenish color that falls in the wavelength range 600-640 nm. Various concentrations of washed water samples were recorded at the wavelength of 625nm. These results were compared with the standard malachite green sample graph founded on Google [21].

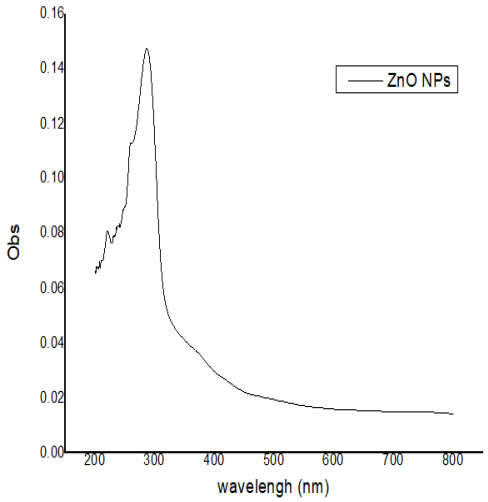


Fig.3 UV spectra of ZnO NPs

At the same time, dry green pea-washed water samples are also recorded in the UV spectrum. So, it was observed wavelength 625nm for determination of Malachite Green adulterated in green pea for coloring purpose. At the same time, ZnO NPs were recorded using a UV-Visible absorption spectrophotometer JASCO-V-750 in the range of 200 to 800 nm. A peak prominent absorption was observed and found it as 355 nm in the spectrum. All the UV-Visible absorption spectrophotometer was carried out at room temperature.

From the Comparison of Fig.4 and Fig.5, the MG-dye concentration has been decreased w.r.t Figure 5. The three figs are attached below.

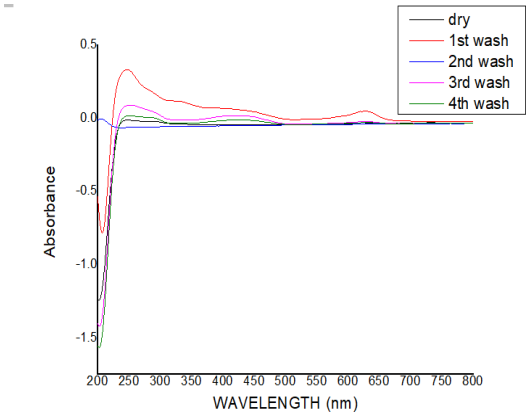


Fig.4 UV spectra of soaked green pea water

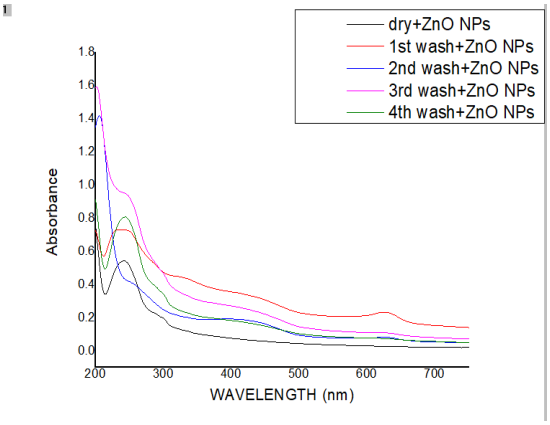


Fig. 5 UV emission spectra of soaked green pea water and ZnO NPs

Fluorescence spectrum: Selection of the Detection Wavelength for fluorescence intensity the washed water sample of green pea and ZnO NPs are mixed with Soaked green pea water was recorded using a Fluorescence spectrophotometer JASCO-FP-8300 was used to record the Emission spectrum for soaked green pea washed dye water in the range of 200 to 750nm. We observed one prominent absorption peak 310 nm in the spectrum. As malachite green is a greenish color that falls in the wavelength range 300-340 nm. Various concentrations of washed water samples were recorded at the wavelength of 310 nm.

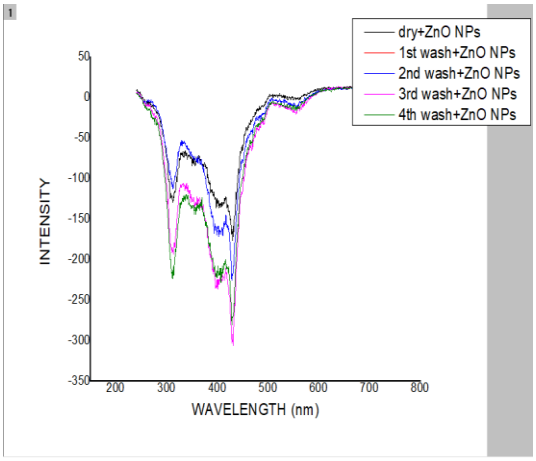


Fig. 5 UV spectra of soaked green pea water and ZnO NPs

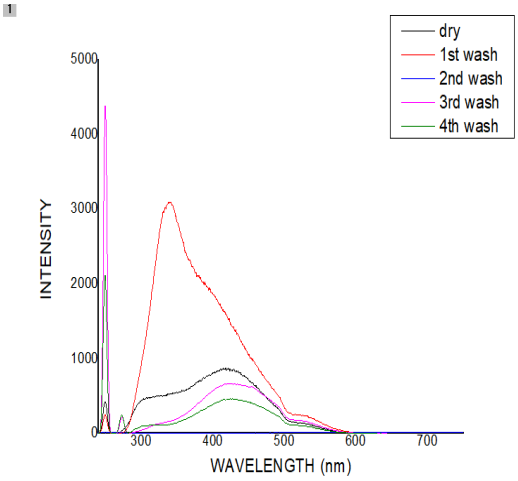


Fig. 6 UV emission spectra of soaked green pea water

These results were compared with the standard malachite green sample graph founded on google. At the same time, dry green pea-washed water samples are also recorded in the UV spectrum. So it was observed to have a wavelength 310 nm for determination of Malachite Green adulterer in green pea for coloring purposes. From the Comparison of Fig.5 and Fig.6, the MG-dye concentration has been decreased w.r.t Figure 6. The three figures are attached below

### 3.4 Antimicrobial Susceptibility Test

The Muller- Hinton plates were prepared as per the procedure in molten media. The test plates are solidified for 5 minutes and plates were rinsed by in column suspension solution. Then the extracts were applied in the plate at the concentrations of 40 mg/disc. The sample loaded disc was placed in incubator 37 $^{0}$C for 24 hours. After 24 hours inhibition zones were measured from the formed inhibition zone with a transparent ruler in millimeters.

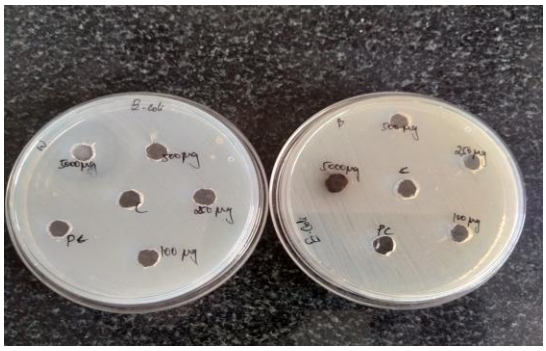

Fig.7 Anti-microbial activity of ZnO NPs

Table 2 : Anti-microbial activity of ZnO NPs

| Sample Code | Organisms | Control | Concentrations (mg/ml) | | | |
|---|---|---|---|---|---|---|
| AN | Aspergillus Niger | 30 | 100 | 250 | 500 | 5000 |
| EC | Escherichia coli | 30 | 100 | 250 | 500 | 5000 |

## 4. CONCLUSION

Zinc is an indispensable inorganic element universally used in medicine, biology, and food package materials. Zinc metal needs for humans, plants, and animals. Its daily intake is approximately 9-14 mg/day, and approximately 5 mg/day are removed from urine and sweat, and also it is very less toxic. So it is used to degrade the malachite green color in food material like a pea. We have studied two types of spectral processes to go through the process of detection of Malachite Green color contaminated in the meaning of malachite green color adulterated washed water of dry and soaked green peas. These two experiments were performed to detect and confirm malachite green adulter-

ants presented in soaked green peas. So adulteration of food can cause very serious effects on the human body when daily consumption without our knowledge. It can be prevented by the addition of ZnO NPs to be used. Both, local and branded food items to be checked by government bodies. This article has tried to create awareness of our people.

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**REFERENCES**

[1] Mandeep Kaur Purba, Sudhir Kumar Shukla, " detection of non-permitted food colors in edibles edibles", Journal of Forensic Research, S4, Jan 2015.

[2] Food Safety Matters, PODCAST, "tim stus:uniting the dairy industry in food safety goals" FDA's Regulatory process and Historical Perspectives Food Safety Magazine, Ep. 121. 2003.

[3] International Food Information Council (IFIC) an U.S.Food and Drug Administration, "Overview of food ingredients, additives and colors- consumer information on ingredients and packaging", April 2010.

[4] Ahmed Alharbi and Ehab A.Abderahman , "Efficient photocatalytic degradation of malachite reen dye using facilely synthesized hematite nanopaticles from Egyptal insecticide cans", Elsevier, Spectromica Acta Part !: Molecularr and Biomolecular Spectrosopy, Vol.226, Feb 2020

[5] M.Veronica, M. Munde John, Onyari Benson and N. Wamalwa John,Enviro. Che. and Ecoto. " Environmental distribution and risk of exposure of heavy metal pollutants from lolgorian artisanal gold mining in kenya", (2020).

[6] Xiao-Ye Wang, Xuelin Yao and Klaus Mullen, "Polycyclic aromatic hydrocanrbons in the grapheme era", Science Chin Chemstry, 62, pp. 1099-1144, 2019.
https://doi.org/10.3390/ma11071197

[7] Hamidreza Sadeh, "Surface modifications of MWCNTs with Carboxylic-to-Amine and their suerb adsorption performance", International Journal of Environmental Research Adsorption Performance, 13(3), April 2019.
https://doi.org/10.1016/j.molliq.2015.12.073

[8] A.Banuelos Jennifer, Rodriuez J.Francisco,Maniquez Rocha Juan, " Novel Electro Fenton Approach for Regeneration of Acticated Carbon", Environmental Science & Technology, p 9117971, July 2013.
doi: 10.1016/j.jece.2016.03.012

[9] A.S.Eltaweil, H. Ali Mohamed Eman, M. Abd El-Monaemand G. M. El-Subruiti, Ad. Pow. Tech., 2020.Online. Available:
doi: 10.1016/j.apt.2020.01.005

[10] Alaa Mohamed. Mohame M.Ghobara, M.K.Abdelmaksoud and Gehad G.Mohamed, " A novel and highly efficient photocatalytic degradation of malachite green dye via suface modified polycrylontrile nanofibers/biogenic silica composite nanofibers", Elsevier, Seperation and Purification Technology, Vol. 210, pp.935-342, Feb 2019.
doi: 10.1016/j.seppur.2018.09.014

[11] R.Wang, L.Zhang,S.Zou, H.Zhang, " Electro deposition of nanodndrites SERS substrates for detection of maachite green, Elsevier, Microchemical Journal,p 9117971,2019.
doi: 10.1016/j.microc.2019.104127.

[12] Elvan Ekman, Mustafa Bilici, Eylem Turan, Ugur Tamerand Adem Zengin, Sen. and Actua.B, 325,1287887, (2020) ( Online) . Available:
doi: 10.1016/j.snb.2020.128787

[13] R.Saravanan, H. Shanker, G. Rajasudha, V.Narayananand A.Stepehen, Int. J. Nanosci., 10, 256-257(2011),online. Available: https://doi.org/10.1142/S0219581X11007867

[14] B.Shouli, C.Liangyuan, L.Dianqing, Y.Wenshengand Y.Pengcheng,. Sen. and Actuat. B:146,129(2010), online. Available. https://doi.org/10.1016/j.snb.2010.02.011

[15] Sangita Bansal, A. singh, M. Mangal, A. Mangaland S. Kumar, criti.Review. in food scienceand nutria., pp. 1174-1189, 2017. http://dx.doi.org/10.1080/10408398.2014.967834.

[16] Mandeep kaur pradeep, J.Foren. Research, " Detection of non-permitted food colours in edibles", S4:3, (2015). doi: 10.4172/2157-7145.1000S4-003

[17] Confederation of Indian Iindustry "The prevention of food adulteration act and rules as on 01.10.2004", New Delhi,2014..

[18] Shruthi Awasth,Kirthi jain, Anwesha Das and Raa Alam, " Analysis of food quality and food adulterants from different departmental and local rocery stores by qualitative analyss for food safety", OSR Journal of Environmental Science, 8(2), pp.22-26,Jan 2014.

[19] U.S Food Drug Administration, " Guidance for industry : Ation levels for poisonous or deleterious substances in human food deleterious substances in human food anmal feed, Centre for Food Safety and Applied Nutrition, Washngton, 2000.

[20] Natural Institute of Health and family welfare , "Presentation of food adulteration act 1954 ", Government of India, Annual Report 2001-2202".

[21] James M.Dixon and Mashiko Taniguchi, " Photochem CAD2: A refined program with accompanying spectral databases for photochemical calculations", Photochemistry and Photobiology, May 2007.