WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 8.084
Volume 10, Issue 5, 1612-1620. Research Article ISSN 2277– 7105

EVALUATION ON EFFICACY OF ROCK SALT AND VINEGAR SOLUTIONS IN REDUCING THE RESIDUAL TOXIC PESTICIDES FROM THE SURFACE OF LADY FINGER

Shadma Siddiqui[1], C. B. S. Dangi[2], Rajnandani Katariya[3] and Mayank Tenguria*[3]

[1]Professor, Dept. of Paramedical Sciences, SAM Global University, Raisen, M.P. India.

[2]Professor & Dean Faculty of Science, RKDF University, Bhopal, M.P. India.

[3]Biomedical & Biopharmaceutical Division, Lenience Biotech Lab, Bhopal, M.P. India.

Article Received on
09 March 2021,

Revised on 30 March 2021,
Accepted on 19 April 2021

DOI: 10.20959/wjpr20215-20396

***Corresponding Author**
Dr. Mayank Tenguria
Biomedical & Biopharmaceutical Division, Lenience Biotech Lab, Bhopal, M.P. India.

ABSTRACT

Due to the potential harmful & toxic effects of pesticide to other non-targeted organisms than pests and diseases the presence of pesticide residues in fruits and vegetables is a concern for consumers. Some of the pesticides are persistent and therefore remain in the body causing long term exposure. With reference an earlier study Lady's finger is supposed to be the most contaminated vegetable with residues of 18 pesticides belonging to organophosphate class. The washing fruits & vegetable with water or soaking in solutions of salt and some chemicals e.g. chlorine, chlorine dioxide, hydrogen peroxide, ozone, acetic acid, hydroxy peracetic acid, iprodione and detergents are reported to be highly effective in reducing the level of pesticides. So the objective of the present investigation, was to evaluate the efficacy of Rock Salt solution and Vinegar Water for removal of pesticide residue from ladies finger, after soaking it for 2-4 hrs rendering it safe for consumption. Reduction in residual content of malathion pesticide from lady figure after washing with distilled water, rock salt solution and vinegar solution was considered in present study. Qualitative analysis of malathion was done by HPLC method the retention time of malathion was found to be 2.825±0.3, and in given sample the retention time in water (2.072) and RS (2.559) was found similar to malathion (2.825) retention time, which confirm the presence of malathion in given water and RS (Rock Salt) sample. The outcomes of the present investigation encourages use of rock salt solution and vinegar solution for cleaning of fruits & vegetables in order to reduce the harmful chemical

pesticide residues, where saindhav lavan jal (Rock salt solution) has proved to be the best media as compared to distilled water and vinegar solution in present study.

KEYWORDS: pesticide residue, HPLC, rock salt, vinegar, vegetable wash.

INTRODUCTION

For pest management, pesticides are used during cropping to destroy pests and prevent diseases. However, the use of pesticides during production often leads to the presence of pesticide residues in fruits and vegetables after harvest (Carriger *et al*., 2006; Mebdoua, 2018). Due to the potential harmful & toxic effects of pesticide to other non-targeted organisms than pests and diseases the presence of pesticide residues in fruits and vegetables is a concern for consumers, interfering with the reproductive systems and foetal development as well as their capacity to cause cancer and asthma in particular (Echobinchon, 1996). Some of the pesticides are persistent and therefore remain in the body causing long term exposure.

Lady's finger or *Abelmoschus esculentus* is an economically important vegetable grown in the tropical and sub-tropical part of the world. Because of its robust nature, dietary fiber and distinct seed protein balance of both lysine and tryptophan amino acids it is a good source of high fiber, Vit-C, folate, Calcium, Potassium, poly saccharides and anti-oxidants (Bawa, and Badrie, 2016). However, cultivation of okra crop suffers a number of biotic and abiotic factors, including insect pests and diseases and thus prone to many kinds of depreciations right from the time of harvesting to yielding (Arain, *et al*., 2012). With reference an earlier study Lady's finger is supposed to be the most contaminated vegetable with residues of 18 pesticides belonging to organophosphate class. All organophosphates have a common mechanism of toxicity and can cause similar symptoms in humans who have too much exposure (Sherman, 1995). Where consumers are now aware of the fact that, simply washing vegetables with tap water does not remove these harmful chemicals and remains in notion for safe consumption. The washing with water or soaking in solutions of salt and some chemicals e.g. chlorine, chlorine dioxide, hydrogen peroxide, ozone, acetic acid, hydroxy peracetic acid, iprodione and detergents are reported to be highly effective in reducing the level of pesticides (Bajwa, & Sandhu, 2014).

Rock Salt "Saindhav lavan" in hindi, is one among 5 salts described by Ayurveda whose main composition is sodium chloride. In Ayurveda Rock salt has been considered to pacify all the three doshas (Vata, Pitta and Kapha) and its use is recommended in day to day life by

Ayurveda acharyas since its being considered as the healthiest form of salt in Ayurveda (Khandelwal, *et al*., 2012). Where, acetic acid, the volatile organic acid popular as vinegar, is responsible for the tart flavor and pungent, biting odor of vinegars. Other constituents of vinegar include vitamins, mineral salts, amino acids, polyphenolic compounds like, galic acid, catechin, caffeic acid, ferulic acid; and nonvolatile organic acids like, tartaric, citric, malic, lactic (Johnston & Gaas, 2006). The antimicrobial properties of vinegar in the context of food preparation have been recently described by researchers, however, the use of undiluted vinegar is also mentions for cleaning of dentures (Entani, *et al*., 1998; Shay, 2000; Sengun and Karapinar, 2005). Coconut and cane vinegar, containing 4-7 % acetic acid is commonly used in India.

So the objective of the present investigation, was to evaluate the efficacy of Rock Salt solution and Vinegar Water for removal of pesticide residue from ladies finger, after soaking it for 2-4 hrs rendering it safe for consumption.

MATERIALS AND METHODS

Sample Collection

For present investigation, the lady finger samples were collected directly from the villages around Bhopal city, M.P. India where use of pesticides on vegetable crops is common practice. The fresh sample were brought to laboratory and kept at –20^{o}C in a refrigerator till the start of experiment.

Experimental plan

In present investigation, malathion was considered to be analyte of interest that was supposed to be detected as residual pesticide from collected lady finger samples. There were three groups of lady finger were prepared; Group-1 would be washed with plain distilled water, Group-2 would be washed with water containing rock salt at 10 g/l concentration and Group-3 would be washed with water containing vinegar at 10 gm/l concentration. Each group was subjected to washing with their respected solution for 2 hours. The washed and cleaned samples would be then subjected to homogenization followed by extraction of analyte for quantitative analysis.

Sample Extraction

The extraction of vegetable samples was done according to the method suggested by William, (2005); Salman, and Ahmed, (2016), with suitable modification as per the requirement of

present investigation. For which 10 gm of vegetable samples was cut into small pieces and blended first then put into 250 ml of conical flask containing 100 ml of 1:1 hexane and acetone mixture. Sodium sulphate was also added to remove the water from sample. The maceration was allowed overnight followed by filtration through a clean cotton pad. The filtrate so obtained was centrifuged at 4000 rpm for 20 minutes. The supernatant is then carefully transferred to 10 ml volumetric flask and allowed to evaporate till dryness to obtain extract which was finally redissolved in 5 ml of acetonitrile. This liquid portion was filtered through a 0.45 µm dissociable nylon syringe filter twice then subjected to HPLC analysis.

Preparation of Standard Stock

10 mg of malathion (Sigma Aldrich) was used to prepare 1000ppm stock solution in acetonitrile, 1 ml of which was then used to suitably diluted to prepare a dilution series of standard concentrations of analyte which is depicted in table 1.

HPLC Analysis for Pesticide Residues

The prepared samples were analyzed on Isocratic HPLC system (Shimadzu LC-10) as per the method suggested by Ohlin (1986) and Dekok and Himestra in (1992) with suitable modification. The chromatographic conditions for analysis includes use of 250mm x 4.60mm, 5 µm particle size reverse phase C-18 column (from Thermo Fisher); the mobile phase used was 7:3 mixture of Acetonitrile and distilled water at a flow rate of 1ml/min maintained at ambient temperature. 20 µl of prepared samples extracts were injected in the system which were detected by UV/visible detector at 230 nm wavelength that was showing peak of detection at a retention time of 2.825± 0.3 min approx. The residual concentration of malathion pesticide in each samples was evaluated by comparing the reading of sample analytes in the form of area under peak as chromatogram with standard plot malathion prepared under same chromatographic conditions.

RESULTS AND DISCUSSION

The residual content of malathion pesticide in the lady finger samples were analyzed in their extract by comparing the peak areas of their chromatogram at retention time of 2.825± 0.3 min approx. with the calibration curve plot of standard malathion as depicted in table 1 and figure 1.

Table 1: Standard concentration vs peak area generated of standard analyte malathion.

S.N	Conc. (µg/ml)	Area under peak in chromatogram
1	0	0
2	4	12859.9
3	6	16752.9
4	8	21354.6
5	10	23921.4

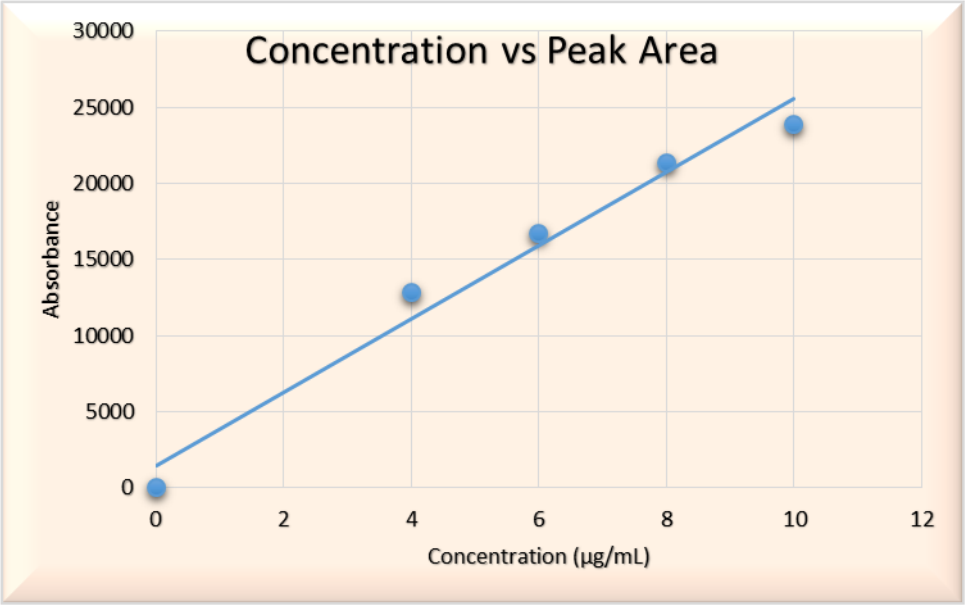

Figure 1: Concentration vs area under chromatographic peak standard curve plot of standard analyte malathion generated by linear regression function in MS Word 2013.

The retention time of malathion in sample extracts prepared from lady finger washed with plain distilled water and rock salt solution are 2.072 min and 2.559 min approx. respectively, which are comparable with retention time of standard analyte malathion *i.e.*, 2.825± 0.3 min approx. which confirm the presence of residual malathion in samples washed with water and rock salt solution. The amount of malathion removed by 3 types of solutions used in study are from per 10 mg of samples is depicted in table 2.

Table 2: Amount of malathion removed upon washing with distillled water, vinegar solution and rock salt solution.

S.N.	Samples	Estimation of Malathion (ng per 10mg)
1.	D.W	0.0291
2.	Vinegar	0.0142
3.	R.S	0.0377

A small amount of the pesticide residue would be considered as removed by distilled water as compared to Saindhav Jal *i.e.*, 2.285% at retention time of 2.072. Vinegar water solution when used for washing of vegetables did extract residues of pesticides from the vegetables *i.e.*, 39.399% in retention time of 1.714. In HPLC, maximum peak was observed in Saindhav Jal (Rock Salt Solution) where, the residue extracted was 0.0377 ng/10 mg, which was greater than distilled water (0.0291 ng/10 mg) and Vinegar solution (0.0142 ng/10 mg). Figures 2, 3 and 4 depict the chromatogram of experiments G-1, G-2 and G-3 groups respectively for malathion residue from treated lady finger samples.

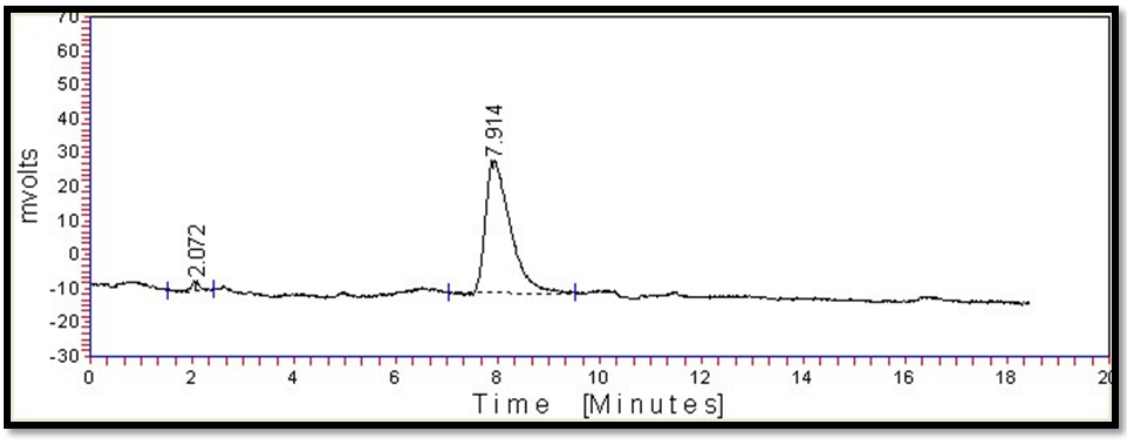

Figure 2: Chromatogram of sample extract G-1 for quantitative estimation of malathion in ladyfinger samples washed with plain distilled water at 230 nm.

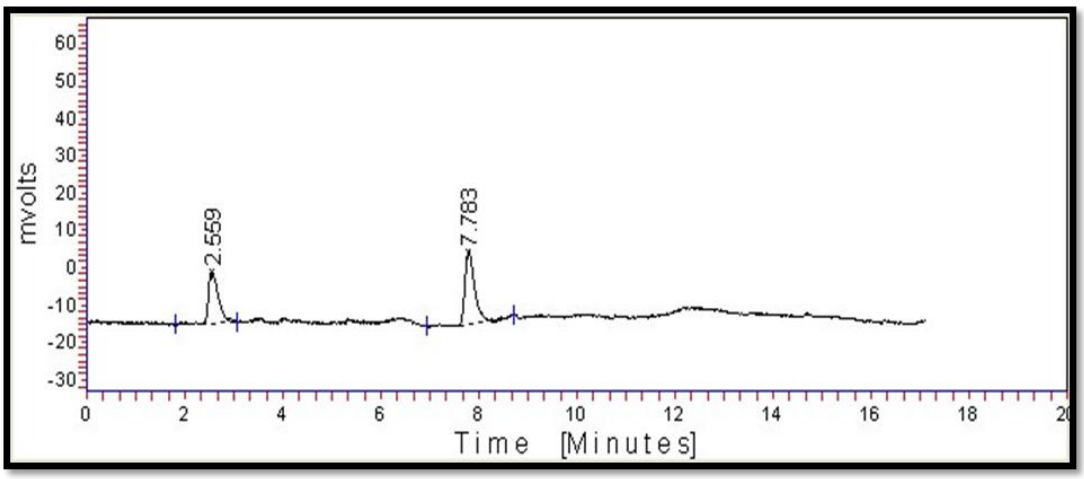

Figure 3: Chromatogram of sample extract G-2 for quantitative estimation of malathion in ladyfinger samples washed with rock salt solution at 230 nm.

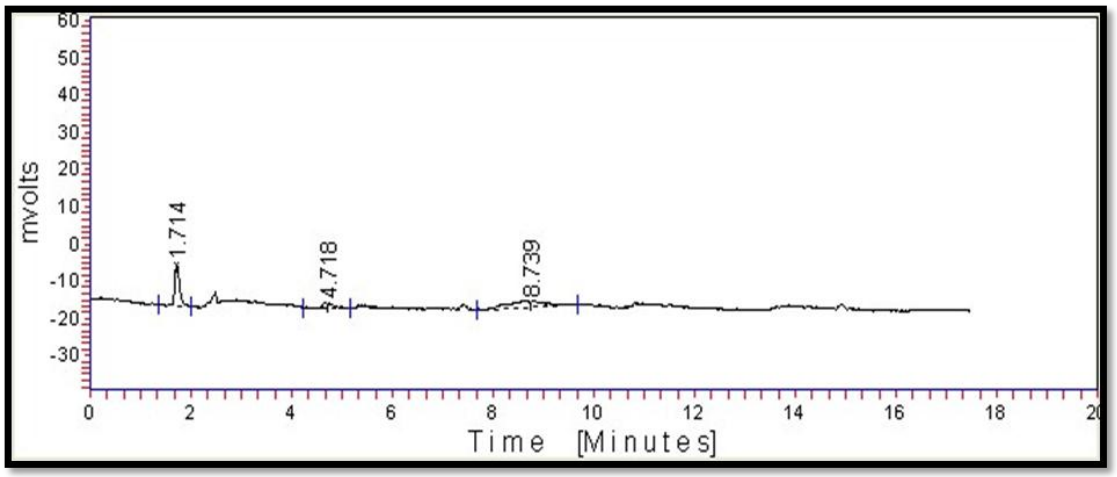

Figure 3: Chromatogram of sample extract G-2 for quantitative estimation of malathion in ladyfinger samples washed with vinegar solution at 230 nm.

Washing of vegetables is the most traditional and preliminary unit operation applied to remove debris and dirt from vegetables prior to consumption. It is the most prevalent practice in every household as it is the cheapest and easiest method of cleaning. Vegetables can be washed with plain water and also with the use of various chemical formulations in commercial and household processing. The extent of residue reduction by washing depends upon the physico-chemical properties of the pesticide, such as water solubility, hydrolytic rate constant, volatility, and octanol-water partition co-efficient in conjugation with the actual physical location of the residue (Echobinchon, 1996).

Washing process lead to reduction of hydrophilic residues which are located on the surface of the crops. It is mention in a recently conducted research from Telangana Agriculture University stated that tap water reduced residues of pesticides only 17-39% (Pnumaka *et al*., 2017).

Moreover the composition of water varies from place to place and sometimes the heavy metals present in it render it unsafe for use. Therefore Distilled water was opted for research and analytical purpose. But it was noticed that only small amount of the pesticide residue was removed by Distilled water as compared to Saindhav jal *i.e*., 2.285% at retention time of 2.072.

Vinegar water solution when used for washing of vegetables did extract residues of pesticides from the vegetables *i.e*., 39.399% in retention time of 1.714, but it affected the taste of the vegetables. Saindhav lavan, (Rock Salt), inherits many medicinal properties and is easily

available in every house (Khandelwal, *et al*., 2012). Probable mode of action may be due to the hydrophilic nature of the pesticide. It was able to extract the residue of pesticide upto 42.033% against a retention time of 2.559.

CONCLUSIONS

India, being an agrarian economy is dependent upon agriculture for its development. Use of pesticides on vegetables is an inevitable part of agriculture but their unscientific usage can cause significant health adversities. There is a need to regulate pesticide intake for leading a healthy life. In a developing country like India, where quite a large proportion of population live below poverty line, burden of deadly diseases can be a great curse. From the extensive review collected on the dissipation of pesticide residues and mechanism involved during household processing techniques it can be concluded that washing of vegetables with saindhav lavan (Rocksalt) has proved to be the best media as compared to distilled water and vinegar solution, to reduce the amount of pesticide residue on various vegetables, to its maximum, rendering it safe for consumption. While the present study used only one pesticide (Malathion), the Agricultural Industry, has access to many more chemicals that can penetrate into human body through various routes.

REFERENCE

1. Arain, A.R., Jiskani, M.M., Wagan, K.H., Khuhro, S.N., and Khaskheli, M.I., (2012). Incidence and chemical control of okra leaf spot disease Pakistan Journal of Botany, 44(5): 1769-1774.
2. Bajwa, U., & Sandhu, K.S., (2014). Effect of handling and processing on pesticide residues in food- a review. *Journal of food science and technology*, *51*(2): 201–220. https://doi.org/10.1007/s13197-011-0499-5
3. Bawa, S.H., and Badrie, N., (2016). Chapter 18 - Nutrient profile, Bioactive Components, and Functional Properties of Okra (*Abelmoschus esculentus* (L.) Moench). In; Fruits, Vegetables, and Herbs| Bioactive Foods in Health Promotion. Academic Press, Pages 365-409, ISBN 9780128029725. https://doi.org/10.1016/B978-0-12-802972-5.00018-4.
4. Carriger JF, Rand GM, Gardinali PR, Perry WB, Tompkins MS, and Fernandez AM. (2006). Pesticides of potential ecological concern in sediment from South Florida canals: an ecological risk prioritization for aquatic arthropods. *Soil and Sediment Contamination*, 15: 21-45.

5. Dekok, A. and Hiemstra, M. (1992). Optimization, automation and validation of the solid-phase extraction cleanup and on-line liquid chromatographic determination of N-methylcarbamate pesticides in fruits and vegetables. J.O.A.A.C.,75(6): 1063-1072.
6. Echobinchon, D.J. (1996). Toxic Effect on Pesticides in: Cassaretti and Daultˮs Toxicology: The Basic Science of Poison 5th ed, Macmillian, New York, 403-405.
7. Entani E, Asai M, Taujihata S, Tsukamoto YK, Ohta M., (1998). Antibacterial action of vinegar against food-borne pathogenic bacteria including Escherichia coli 0157:H7. J Food Prot, 61: 953–959.
8. Johnston, C.S., & Gaas, C.A., (2006). Vinegar: Medicinal Uses and Antiglycemic Effect. *MedGenMed : Medscape general medicine*, 8(2): 61.
9. Khandelwal, N., Dhundi, S., Yadav, P., and Prajapati P.K., (2012). Lavana (salt): An Ayurvedic outlook on Saindhava (Rock salt). *Indian Journal of Ancient Medicine and Yoga*, 5(2): 95-101.
10. Mebdoua, S., (2018). Pesticide Residues in Fruits and Vegetables. In: Mérillon JM., Ramawat K. (eds) Bioactive Molecules in Food. Reference Series in Phytochemistry. Springer, Cham. https://doi.org/10.1007/978-3-319-54528-8_76-1
11. Ohlin, B., (1986). A High Performance Liquid Chromatography Multiresidue Method for Determination Of Pesticides in Fruits and Vegetables. Var Foda Suppl. 2/86:111-124.
12. Pnumaka, R., Boddu, U.R., and Podila, S.P., (2017). Study of Irrigation Water Quality in Chevella Watershed of Rangareddy District, Telangana State, Inida. Indian Journal of Applied Research, 7(3): 383-386.
13. Salman, L.M.A.L., and Ahmed, I.A.M., (2016). Evaluation of Some Pesticide Residues in Fruits import by High Performance Liquid Chromatography. *Al-Mustansiriyah Journal of Science*, 27(4): http://dx.doi.org/10.23851/mjs.v27i4.14
14. Sengun IY, and Karapinar M. (2005). Effectiveness of household natural sanitizers in the elimination of *Salmonella typhimurium* on rocket (*Eruca sativa* Miller) and spring onion (*Allium cepa* L.). Int J Food Microbiol, 98: 319–323.
15. Shay K., (2000). Denture hygiene: a review and update. J Contemp Dent Pract, 15(1): 28–41.
16. Sherman, J.D., (1995). Organophosphate pesticides-neurological and respiratory toxicity. Toxicol Ind Health, 11: 33-39.
17. William L, and George, (2005). Impact of Maximum Residue Limit (MRLs) on Regional and Global Trade. *Agrolinks*, 3(4): 12-14.