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Evaluation of UV-C treatment on *Salmonella* inactivation in chilli powder through VIDAS

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Abstract
Foodborne outbreaks associated with *Salmonella* in low-moisture foods have increased in the last two decades. Concern about the safety of low-moisture foods has also increased. Spices are considered a high-risk low moisture food for *Salmonella.* The decontamination of spices is a crucial step in spice processing. Adapting a non-thermal technology may improve the effectiveness of inactivation. UV-C is electromagnetic radiation that has germicidal activity and was used as a decontamination technique for red chilli powder in this study. The wavelength used for this study is 254nm. And the inactivation of *Salmonella* was evaluated using mini-VIDAS. The result showed that UV-C radiation has an inactivation effect on chilli powder. The UV-treated sample for 15 and 20 minutes showed VIDAS test values of 2.54 and 0.97, which are greater than the threshold values. UV-C cannot inactivate *Salmonella* completely in the sample. So, when combined with other thermal and non-thermal technologies, it may increase the effect of inactivation.

Keywords: *Salmonella,* UV-C, chili powder, VIDAS, test value

Introduction
Foodborne illnesses and outbreaks connected to *Salmonella* have been a major concern around the world. Food has been considered the major carrier source and salmonellosis outbreaks associated with food products include meat, eggs, dairy, poultry, spices, nuts and seeds (USFDA, 2012). Based on the reported *Salmonella* outbreaks and recalls, spices are considered as one of the high-risk, low moisture foods. Although there is evidence that spices have a varied array of bacteria and fungi in their microbiome, there has lately been a rise in the correlation between spices and *Salmonella* (Vij *et al*., 2006) [8]. Some of other low water-activity (LWA) foods besides spices have also been connected to outbreaks of foodborne disease and contamination occurrences (Caver Branden, 2016) [2].
Generally, *Salmonella* will not grow in low-moisture food but once it's affected it may persist in the low moisture environment for months. *Salmonella* also has a high tolerance when exposed to low moisture environments (Gruzdev *et al*., 2011) [4]. UV-C light has a wavelength of 200 to 270 nm will easily absorbed by the DNA and causes a significant amount of pyrimidine dimers to be produced. Affecting the DNA transfer and replication are the response of UV-C absorption by DNA cells, this makes the treatment effective on microbes (Chevremont *et al*., 2012) [3]. Red chilli (*Capsicum annuum*) is also an important commercial spices in the world and is widely consumed. This study represents the investigation of UV-C treatment for *Salmonella* decontamination and its evaluation through VIDAS.

Materials and Methods
Sample collection
Red chilli was procured from the farm in Dindigul, Tamil Nadu, and it was sun-dried for the desired moisture content for milling. The dried red chilli was ground into powder, and it was stored at 4 ºC for further experiments. The procured red chilli powder sample was tested for the presence of *Salmonella*.

Sample preparation and bacterial inoculation: The stored chilli samples were taken out within 2 hours of the experiment to reach room temperature. In order to inoculate the sample, a pre-weighed sample of 100 g was taken in the zip-lock pouches.

The centrifuged pellets obtained from *Salmonella* suspension (Tryptone Soya Broth) were added to the sample and homogenised for 5 min. The inoculated concentration was about 7 $\log_{10}$ per g. Then the inoculated sample was kept for incubation for 1 hour in a biosafety cabinet.

UV-C Treatment

The inoculated sample (30 g) was placed in a petriplate (200 mm x 30 mm) and exposed to a UV-C radiation source with a wavelength of 254 nm (40 W) in the cabinet for 15 and 20 minutes, respectively. The treated product is transferred to the zip-lock cover and stored at 4 ºC for further analysis. The untreated sample, *Salmonella* spiked sample and treated sample were analysed.

VIDAS

VIDAS® UP *Salmonella* (SPT) (bio-Mérieux), is used for the detection of S*almonella.* The SPT assay is performed with an automatic mini-VIDAS instrument. In sterile filter bags, a 1:10 dilution of the sample and buffered peptone water was performed with DILUMAT® (bio-Mérieux). Then the enrichment mixture was homogenised in SMASHER® (bio-Mérieux) and it was incubated for 18 to 24 hours at 41ºC. The 0.5 ml of clear/ filtered, enriched sample was transferred to the VIDAS SPT strip. Then the strip was heated for 5 minutes in VIDAS® HEAT AND GO (bio-Mérieux), and after removing it, it was cooled down for 10 minutes. Then the cooled strips were placed in the VIDAS immunoanalyzer, where the test took 45 minutes to complete. Then the result interpretation was done based on the test value (TV). If the TV is < 0.25, it indicates the absence of *Salmonella* and if the TV is 0.25 or greater, it indicates the presence of *Salmonella.* From the remaining enriched cultures, all presumptive-positive results were confirmed culturally, by streaking onto Xylose Lysine Deoxycholate Agar (XLD), then incubated for 24 hours at 37 ºC.

Result and Discussion

Table 1: Results obtained by mini-VIDAS

S. No	Sample	Test Value	Interpretation
1	Control	0.04	Negative
2	Spiked	3.55	Positive
3	UV- 15 mins	2.54	Positive
4	UV-20 mins	0.97	Positive

The results were automatically evaluated by the mini-VIDAS system. Threshold value (0.25) is considered for result evaluation. Negative result indicates the TV is less than the threshold value and indicates that the sample is absent for *Salmonella o*r may be the concentration below the detection limit. When the test value equal to or greater than the threshold value considered as a positive result and the sample is contaminated by *Salmonella* (Bird, *et al*, 2013). The control sample was found negative for *Salmonella*, and the TV was 0.04, which means there is no *Salmonella* contamination. Spiked chilli powder was found positive for *Salmonella* with a test value of 3.55. UV-C treated samples for 15 and 20 minutes showed positive results with TVs of 2.54 and 0.97, greater than 0.25. The test value was found to decrease for the UV-treated enriched sample when compared to the spiked sample, which indicates a reduction in *Salmonella* count. Positive samples were culturally confirmed with XLD agar, which also showed positive for *Salmonella.* (Hassan *et al*., 2020) [5] observed that there was a decrease in microbial load with an increase in exposure power and time. The inactivation may vary based on the age and spectral properties of the lamp, suggestion for the effective microbial inactivation combination of UV-C with other decontamination technologies may aid in maximizing the antimicrobial effect (Rajkovic *et al*., 2016) [7]. The reduction in *Salmonella* count may be due to DNA damage caused by the non-ionizing radiation.

Conclusion

The impact of UV radiation exposure on red chilli powder was studied through the VIDAS system. The enzyme-linked fluorescent assay was performed to study the effect of UV treatment. The result showed positive results for spiked red chilli powder and UV treated chilli samples, and negative results for the control sample. UV-treated samples were found to have Test Values of 2.54 and 0.97 after 15 and 20 minutes, respectively. And it was found to be less when compared with the spiked sample test value of 3.55. Application of only UV-C is not sufficient for the inactivation of *Salmonella*, Combined treatment methods with other thermal and non-thermal methods are needed for effective inactivation of microbes.

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Reference

1. Foodborne Pathogenic Microorganisms and Natural Toxins, 2nd Ed., T.S. Hammack (Ed.) *Salmonella* species, http://www. fda.gov/downloads/Food/FoodborneIllnesContaminants/ UCM297627.pdf
2. Caver Branden C. Recovery of Salmonella from steam and ethylene oxide-treated spices using supplemented agar with overlay; c2016. p. 1-72. https://vtechworks.lib.vt.edu/handle/10919/81456
3. Chevremont A, Farnet A, Coulomb B, Boudenne J. Science of the Total Environment Effect of coupled UV-A and UV-C LEDs on both microbiological and chemical pollution of urban wastewaters. Science of the Total Environment, The. 2012;426:304–310. https://doi.org/10.1016/j.scitotenv.2012.03.043
4. Gruzdev N, Pinto R, Sela S. Effect of desiccation on tolerance of Salmonella enterica to multiple stresses. Applied and Environmental Microbiology. 2011;77(5):1667–1673. https://doi.org/10.1128/AEM.02156-10
5. Hassan AB, Al Maiman SA, Sir Elkhatim KA, Elbadr NA, Alsulaim S, *et al*. Effect of UV-C radiation treatment on microbial load and antioxidant capacity in hot pepper, fennel and coriander. Lwt. 2020;134:109946. https://doi.org/10.1016/j.lwt.2020.109946
6. Methods M. Environmental Samples : Collaborative Study; c2013. p. 1. https://doi.org/10.5740/jaoacint.CS2013
7. Rajkovic A, Tomasevic I, Meulenaer B De, Devlieghere F. The effect of pulsed UV light on Escherichia coli O157: H7, *Listeria monocytogenes*, *Salmonella typhimurium*, *Staphylococcus aureus* and staphylococcal

enterotoxin A on sliced fermented salami and its chemical quality. Food Control; c2016. p. 1–9. https://doi.org/10.1016/j.foodcont.2016.09.029

8. Vij V, Ailes E, Wolyniak C, Angulo FJ, Klontz KC. Recalls of spices due to bacterial contamination monitored by the U.S. Food and Drug Administration: The predominance of salmonellae. Journal of Food Protection. 2006;69(1):233-237. https://doi.org/10.4315/0362-028X-69.1.233