UV Influence Over *Vibrio* Bacterial Species

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Abstract

Investigations were focused on the UV effect on V.parahaemolyticus, V.vulnificus, V.alginolyticus, V.metschnikovii and V.furnissii. The experiment was performed either on various bacteriological media inseminated with Vibrio germs or on food of animal origin contaminated experimentally.

Our investigations showed that using a normal bacteriological lamp the Vibrio species may be destroyed over maximum 115 minutes until a 10 cm deep in product. The most resistant species was V.alginolyticus and the less resistant was V.parahaemolyticus.

Keywords: Vibrio, UV, bacteriological medium, food of animal origin

Introduction

The present and general interest in vibriosis is proved by bacteriologists, epidemiologists and clinica specialists paying attention to the issue.

Many studies and research papers on infections produced by those bacteria, especially by non-choleric *Vibrio*, papers that have been published in recent years, acquired large interest.

Over the last decade of the past millenium, the fact that non-choleric Vibrio species has been frequently involved in food poisoning of human beings with acute diarheic syndrome has caught the eye of many researchers. Although clinically those vibrioses aren't complicated and are treated efficiently, the epidemiological risk is important because there have been episodes with hundreds of cases.

The grown frequency of non-choleric vibrions isolation from different suprainfected extern lesions has led to statistical studies in isolation frequency of these bacteria from water, sediments and water animals. Hereby, James D. Oliver and collaborators have proved the existence of a direct linkage between the Vibrio species and water animals from different levels of trophic pyramid.

The studies of non-choleric vibrions tolerance to UV radiation have been performed with a view to offer technologists from the food industry the most practical and efficient way for decontamination and sterilization of installations, work tables and surfaces, likely to be contaminated with vibrions.

Materials and Methods

It has obtained bacterial cultivation in 24 h on glucosat salty bulion (BGS) and peptoned salty alkaline water (APSA) with 10^9 CFU/ml which have been exposed to UV

radiation in a liquid column (into glass tube) and repectively on thin layer of 1 cm high (into Petri plate). Samples of fish and sea fruits have also been contaminated experimentally (by homogenisation in Stomacher of 250 g sample with 25 ml of glucosat salty bulion with 10^9 CFU/ml) and exposed on a 10 cm layer (into crystallizer).

The bacterial stems used have been: *V.parahaemolyticus* (stem 256p; stem 816p; stem 1477; stem 679; stem 192p), *V.vulnificus* (stem 625v; stem 512v; stem 1215v; stem 2569; stem 2548), *V.alginolyticus* (stem 196a; stem 216a; stem 225a; stem 1432), *V.metschnikovii* (stem 2682; stem 2696) and *V.furnissii* (stem 3781; stem 3788).

The resistance control has been made after different time intervals of exposure to UV radiation: 5 minutes, 15 minutes, 30 minutes, 45 minutes, 60 minutes, 75 minutes, 90 minutes, 115 minutes, 130 minutes through culturing by directly striating on TCBS and TSAT, then incubated 18 h at 37 ^{O}C.

Results and Discusions

We are showing the results under the form of charts:

Table 1. Tolerance of V. parahaemolyticus at UV rays.

Vibrio stem	Used medium	Exposing mode	Time of exposing (minutes)								
			5’	15’	30’	45’	60’	75’	90’	115’	130’
V. parahaemolyticus 256 p	APSA	Into tube	10^9	10^8	10^6	10^3	10^1	0	0	0	0
	APSA	Into Petri plate	10^9	10^7	10^5	10^2	10^1	0	0	0	0
	BGS	Into tube	10^9	10^8	10^6	10^4	10^2	0	0	0	0
	BGS	Into Petri plate	10^9	10^8	10^7	10^3	10^1	0	0	0	0
	Fish sample	By crystallizer	10^9	10^8	10^5	10^4	10^1	0	0	0	0
	Sea fruit sample	By crystallizer	10^9	10^8	10^6	10^3	10^1	0	0	0	0
V. parahaemolyticus 816 p	APSA	Into tube	10^9	10^9	10^6	10^3	10^1	0	0	0	0
	APSA	Into Petri plate	10^9	10^8	10^5	10^2	0	0	0	0	0
	BGS	Into tube	10^9	10^8	10^6	10^3	10^1	0	0	0	0
	BGS	Into Petri plate	10^9	10^7	10^6	10^2	0	0	0	0	0
	Fish sample	By crystallizer	10^9	10^8	10^6	10^2	10^1	0	0	0	0
	Sea fruit sample	By crystallizer	10^9	10^8	10^5	10^3	10^1	0	0	0	0
V. parahaemolyticus 1477	APSA	Into tube	10^9	10^7	10^7	10^4	10^1	10^1	0	0	0
	APSA	Into Petri plate	10^9	10^8	10^6	10^3	10^1	0	0	0	0
	BGS	Into tube	10^9	10^8	10^5	10^1	0	0	0	0	0
	BGS	Into Petri plate	10^9	10^7	10^6	10^2	0	0	0	0	0
	Fish sample	By crystallizer	10^9	10^7	10^6	10^2	10^1	0	0	0	0
	Sea fruit sample	By crystallizer	10^9	10^8	10^6	10^3	10^1	0	0	0	0
V. parahaemolyticus 679	APSA	Into tube	10^9	10^8	10^5	10^2	0	0	0	0	0
	APSA	Into Petri plate	10^9	10^8	10^6	10^3	10^1	0	0	0	0
	BGS	Into tube	10^9	10^7	10^6	10^4	10^2	10^1	0	0	0
	BGS	Into Petri plate	10^9	10^9	10^7	10^3	10^1	0	0	0	0
	Fish sample	By crystallizer	10^9	10^8	10^7	10^2	10^1	0	0	0	0
	Sea fruit sample	By crystallizer	10^9	10^8	10^7	10^3	10^2	0	0	0	0
V. parahaemolyticus 192 p	APSA	Into tube	10^9	10^8	10^6	10^4	10^1	0	0	0	0
	APSA	Into Petri plate	10^9	10^7	10^5	10^2	0	0	0	0	0
	BGS	Into tube	10^9	10^7	10^5	10^1	0	0	0	0	0
	BGS	Into Petri plate	10^9	10^8	10^6	10^2	0	0	0	0	0
	Fish sample	By crystallizer	10^9	10^8	10^6	10^2	0	0	0	0	0
	Sea fruit sample	By crystallizer	10^9	10^8	10^6	10^3	10^1	0	0	0	0

The resistance of *V.parahaemolyticus* to UV radiation is reduced in 75 minutes of action but in two situations it was observed that 10 CFU/ml remain; in both of them the remanence was achieved a liquid column (in tubes) because the UV radiation penetrates with more difficult. In the samples that were contaminated by means of the experiment, the vibrions are quickly neutralized even if the exposure is done in a thick layer.

Table 2. Tolerance of V. vulnificus to UV radiation.

Vibrio stem	Used medium	Exposing mode	Time of exposing (minutes)								
			5	15	30	45	60	75	90	115	130
V. vulnificus 625 v	APSA	Into tube	10^9	10^9	10^7	10^6	10^2	0	0	0	0
	APSA	Into Petri plate	10^9	10^8	10^5	10^4	10^2	10^1	10^1	0	0
	BGS	Into tube	10^9	10^9	10^6	10^5	10^1	0	0	0	0
	BGS	Into Petri plate	10^9	10^7	10^6	10^4	10^1	10^1	0	0	0
	Fish sample	By crystallizer	10^9	10^8	10^6	10^5	10^2	10^1	10^1	0	0
	Sea fruit sample	By crystallizer	10^9	10^8	10^6	10^5	10^2	10^1	10^1	0	0
V. vulnificus 512 v	APSA	Into tube	10^9	10^9	10^7	10^3	10^1	0	0	0	0
	APSA	Into Petri plate	10^9	10^8	10^5	10^3	10^1	10^1	0	0	0
	BGS	Into tube	10^9	10^7	10^6	10^4	10^2	10^1	10^1	0	0
	BGS	Into Petri plate	10^9	10^8	10^6	10^3	10^1	0	0	0	0
	Fish sample	By crystallizer	10^9	10^8	10^6	10^3	10^1	0	0	0	0
	Sea fruit sample	By crystallizer	10^9	10^9	10^6	10^4	10^2	10^1	0	0	0
V. vulnificus 1215 v	APSA	Into tube	10^9	10^8	10^7	10^5	10^2	0	0	0	0
	APSA	Into Petri plate	10^9	10^7	10^5	10^4	10^2	0	0	0	0
	BGS	Into tube	10^9	10^8	10^6	10^2	10^1	0	0	0	0
	BGS	Into Petri plate	10^9	10^8	10^6	10^3	10^1	10^1	0	0	0
	Fish sample	By crystallizer	10^9	10^8	10^5	10^3	10^1	0	0	0	0
	Sea fruit sample	By crystallizer	10^9	10^8	10^6	10^3	10^1	10^1	0	0	0
V. vulnificus 2569	APSA	Into tube	10^9	10^7	10^7	10^5	10^2	10^1	0	0	0
	APSA	Into Petri plate	10^9	10^7	10^6	10^3	10^1	0	0	0	0
	BGS	Into tube	10^9	10^8	10^5	10^2	0	0	0	0	0
	BGS	Into Petri plate	10^9	10^8	10^6	10^3	10^1	0	0	0	0
	Fish sample	By crystallizer	10^9	10^7	10^6	10^3	0	0	0	0	0
	Sea fruit sample	By crystallizer	10^9	10^8	10^6	10^3	0	0	0	0	0
V. vulnificus 2548	APSA	Into tube	10^9	10^7	10^6	10^4	10^2	0	0	0	0
	APSA	Into Petri plate	10^9	10^9	10^7	10^3	10^1	10^1	0	0	0
	BGS	Into tube	10^9	10^8	10^6	10^5	10^2	10^1	0	0	0
	BGS	Into Petri plate	10^9	10^9	10^7	10^3	10^1	0	0	0	0
	Fish sample	By crystallizer	10^9	10^9	10^7	10^4	10^1	0	0	0	0
	Sea fruit sample	By crystallizer	10^9	10^8	10^6	10^4	10^1	10^1	0	0	0

The tolerance of *V. vulnificus* to UV radiation is older, observing that in 90 minutes two stems remain at 10 CFU/ml concentration level.

Table 3. Tolerance of V. alginolyticus to UV radiation.

Vibrio stem	Used medium	Exposing mode	Time of exposing (minutes)								
			5	15	30	45	60	75	90	115	130
V. alginolyticus 196 a	APSA	Into tube	10^9	10^9	10^7	10^4	10^1	0	0	0	0
	APSA	Into Petri plate	10^9	10^8	10^6	10^3	10^1	10^1	0	0	0
	BGS	Into tube	10^9	10^7	10^6	10^5	10^2	10^1	0	0	0
	BGS	Into Petri plate	10^9	10^9	10^8	10^4	10^1	0	0	0	0
	Fish sample	By crystallizer	10^9	10^8	10^7	10^3	10^1	10^1	0	0	0
	Sea fruit sample	By crystallizer	10^9	10^8	10^7	10^4	10^1	10^1	0	0	0
V. alginolyticus 216 a	APSA	Into tube	10^9	10^8	10^6	10^3	10^1	0	0	0	0
	APSA	Into Petri plate	10^9	10^9	10^7	10^5	10^2	10^1	0	0	0
	BGS	Into tube	10^9	10^7	10^6	10^4	10^1	0	0	0	0
	BGS	Into Petri plate	10^9	10^9	10^7	10^3	10^1	10^1	10^1	0	0
	Fish sample	By crystallizer	10^9	10^8	10^6	10^4	10^1	0	0	0	0
	Sea fruit sample	By crystallizer	10^9	10^8	10^7	10^4	10^1	10^1	0	0	0
V. alginolyticus 225 a	APSA	Into tube	10^9	10^8	10^7	10^4	10^1	10^1	10^1	0	0
	APSA	Into Petri plate	10^9	10^8	10^6	10^3	10^1	0	0	0	0
	BGS	Into tube	10^9	10^7	10^6	10^2	0	0	0	0	0
	BGS	Into Petri plate	10^9	10^9	10^7	10^4	10^2	10^1	10^1	10^1	0
	Fish sample	By crystallizer	10^9	10^8	10^6	10^3	10^2	10^1	10^1	0	0
	Sea fruit sample	By crystallizer	10^9	10^8	10^7	10^3	10^2	10^1	10^1	0	0
V. alginolyticus 1432	APSA	Into tube	10^9	10^8	10^6	10^3	10^1	0	0	0	0
	APSA	Into Petri plate	10^9	10^7	10^6	10^2	10^1	10^1	0	0	0
	BGS	Into tube	10^9	10^7	10^7	10^5	10^2	10^1	0	0	0
	BGS	Into Petri plate	10^9	10^8	10^6	10^3	10^1	0	0	0	0
	Fish sample	By crystallizer	10^9	10^8	10^6	10^3	10^1	0	0	0	0
	Sea fruit sample	By crystallizer	10^9	10^7	10^7	10^2	10^1	10^1	0	0	0

The studies on V. alginolyticus demonstrate that vibrions persist up to 115 minutes of exposure (in only one case), even if after 75 minutes the bacterial concentration is low (10 CFU/ml into all cases).

Table 4. Tolerance of V. metschnikovii to UV radiation.

Vibrio stem	Used medium	Exposing mode	Time of exposing (minutes)								
			5	15	30	45	60	75	90	115	130
V. metschnikovii 2682	APSA	Into tube	10^9	10^9	10^6	10^4	10^1	0	0	0	0
	APSA	Into Petri plate	10^9	10^7	10^7	10^2	0	0	0	0	0
	BGS	Into tube	10^9	10^8	10^7	10^4	10^1	10^1	0	0	0
	BGS	Into Petri plate	10^9	10^7	10^6	10^3	10^1	0	0	0	0
	Fish sample	By crystallizer	10^9	10^8	10^7	10^4	0	0	0	0	0
	Sea fruit sample	By crystallizer	10^9	10^8	10^7	10^4	10^1	0	0	0	0
V. metschnikovii 2696	APSA	Into tube	10^9	10^8	10^7	10^5	10^2	10^1	0	0	0
	APSA	Into Petri plate	10^9	10^8	10^8	10^5	10^1	0	0	0	0
	BGS	Into tube	10^9	10^7	10^7	10^3	10^1	0	0	0	0
	BGS	Into Petri plate	10^9	10^8	10^7	10^4	10^2	10^1	0	0	0
	Fish sample	By crystallizer	10^9	10^8	10^7	10^5	10^1	0	0	0	0
	Sea fruit sample	By crystallizer	10^9	10^8	10^7	10^6	10^1	0	0	0	0

The species of *V.metschnikovii* has a low tolerance to UV radiation, comparative with tolerance of *V. parahaemolyticus*, although the vibrions resistance to an exposure of 75 minutes has been more frequently observed.

Table 5. Tolerance of V. furnisii to UV radiation.

Vibrio stem	Used medium	Exposing mode	Time of exposing (minutes)								
			5	15	30	45	60	75	90	115	130
V. furnissii 3781	APSA	Into tube	10^9	10^8	17^8	10^4	10^1	10^1	0	0	0
	APSA	Into Petri plate	10^9	10^7	10^7	10^2	0	0	0	0	0
	BGS	Into tube	10^9	10^7	10^7	10^3	0	0	0	0	0
	BGS	Into Petri plate	10^9	10^8	10^6	10^4	10^1	10^1	0	0	0
	Fish sample	By crystallizer	10^9	10^7	10^7	10^3	0	0	0	0	0
	Sea fruit sample	By crystallizer	10^9	10^7	10^7	10^3	10^1	0	0	0	0
V. furnissii 3788	APSA	Into tube	10^9	10^8	10^7	10^3	10^1	10^1	0	0	0
	APSA	Into Petri plate	10^9	10^8	10^7	10^5	10^2	10^1	10^1	0	0
	BGS	Into tube	10^9	10^9	10^7	10^4	10^1	0	0	0	0
	BGS	Into Petri plate	10^9	10^7	10^6	10^3	10^1	0	0	0	0
	Fish sample	By crystallizer	10^9	10^8	10^7	10^4	10^1	0	0	0	0
	Sea fruit sample	By crystallizer	10^9	10^8	10^7	10^4	10^1	10^1	10^1	0	0

V. furnisii shows similar resistance with *V. vulnificus*, vibrions resisting (mostly in experimental contaminations) up to 90 minutes of exposure.

Conclusions

1. The most resistant species to UV radiation is V. *alginolyticus*, the destruction following after 130 minutes of exposure.

2. The lowest level of tolerance on UV is recorded by *V.parahaemolyticus* which after 75 minutes of exposure is destroyed in most cases, and after 90 minutes it is total destroyed.

3. Indifferent of nutritive substratum in which grown (contaminated samples or bacterian medium) the wrack of vibrions by exposure on UV rays is ditto efficaciously.
4. Indifferent of thickness substratum in which the exposure has done (from 1 cm to 10 cm) the action of UV rays is ditto efficaciously.

The final conclusion is that UV radiation could be used as an efficient method of decontamination of installations and surfaces, especially in the food industry, for meat preparation, storage and preservation of fish and water products, where contaminations with vibrions are frequently recorded.

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