

ABOUT MECHANISM OF ANTISEPTIC ACTION OF MODIFIED CARBON MATERIALS

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Introduction

It is known that the modification by copper (II) of the carbon sorbents increase their bactericidal affinity and sorption ability for bacteria and viruses. Mechanism of the cholera vibrio adsorption of carbon sorbents modified by copper (II) is very complex because there are many factors which influence on this interaction [1].

Our study provides some insight to the mechanism by which cholera vibrio is removed from water by copper (II) forms of carbon materials in point view of protein adsorption in solution, so as cholera vibrio contain 61-71% albumen molecules.

Experimental

The synthesis of the modified forms by copper (II) of carbon fabric type "AUVM- Dnepr " and carbon felt has been published earlier [2]. The adsorption of alkali albumen trypsin (SPOFA) by modified forms of carbon materials was studied in 0,1 M phosphate buffer (pH=5,0) with concentration of trypsin 0,5mg/ml at continuous shaking up during 60 minutes at temperature 22^o C. Sorptive pore volume of benzol and water were determined by the adsorption of benzol and water steam respectively by the weight method. The investigation of the carbon materials sorption ability for cholera vibrio carry out the sea water in the epidemiological region (1995), by the method of serial dilution.

Results and Discussion

The structural – sorptive characteristics of carbon materials and their modified by copper (II) forms illustrate in table 1. It was found that the content of copper (II) in sorbents in space of 2-4 mg/g did not changed essentially parameters of carbon fabric and felt but changed its surface chemistry. About this testify to the decreasing of pH zero of charge surface by modification of copper (II) ions (Table 1). The shape of the adsorption isotherm of trypsin on the carbon fabric in phosphate buffer testify to the absence of saturated plato and attitude to Lenqmuire type isotherm (L₁ class) according to Giles classification (Fig.1) It was found that carbon fabric adsorbed the trypsin as larger as

smaller ratio of solid and liquid phases. The modification by copper (II) of carbon fabric lead to increase the trypsin adsorption at 2,0-2,5 times. By analogy with this the influence of the modification was shown at study of the sorptional activity of carbon materials to cholera vibrio (Table 2).

The influence of the nature of carbon materials is displayed at absence of microorganism on the carbon felt, that correlated with the low structural-sorptive characteristics its and more lower kinetic of the cholera vibrio extraction in compare with the carbon fabric. It was established that using the ratio of solid and liquid phase 1: 50, time of the contact 5 minutes and contain of copper (II) in the sorptive material 2,3 mg/g was observed 100% extraction of cholera vibrio from sea water solution. With increase of the cholera vibrio content to 1 million microbe body also was founded 100% extraction its from solutions by the modified carbon fabric. It may be the modification by copper (II) of carbon materials don't only increase their bactericidal properties but it is possible to formate the copper (II) complexes with nitrogen- and oxygen groups of trypsin besides electrostatic interaction of carbon with polar molecules of albumen and the formation of H-bonds with hydroxyl and carbohyl carbon groups. Besides that, ions of copper (II) on the surface of carbon sorbents can be able interact with spiral albumens and neutralize charge.

Conclusions

It was found the correlation between the adsorption of carbon materials toward albumen and cholera vibrio in solutions and increase bacteriocidal properties of carbon sorbents by way of the modification by copper (II).

References

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2. Patent of Ukraine. N17528. Bul. N4, 1998. *Bacteritsidnyi sorbtsionnyi material dlya ochistky vody ot holernogo vibriona*. Strelko VV, Openko NM, Gluschachenko OA, Denisova TI et.al.

Table 1 . The structural – sorptive characteristics of carbon material.

Sorbent	Content of Cu(11), mg/g	Sorptive pore volume, sm ³ /g		Adsorption of methylene blue, mg/g	pH zero of charge surface
		C ₆ H ₆	H ₂ O		
Carbon fabric	-	0,06	<0,01	135	6,8
	2,28	0,05	0,01	75	6,3
Carbon felt (activat.)	-	1,21	0,01	428	7,4
	3,93	1,15	0,02	360	6,6

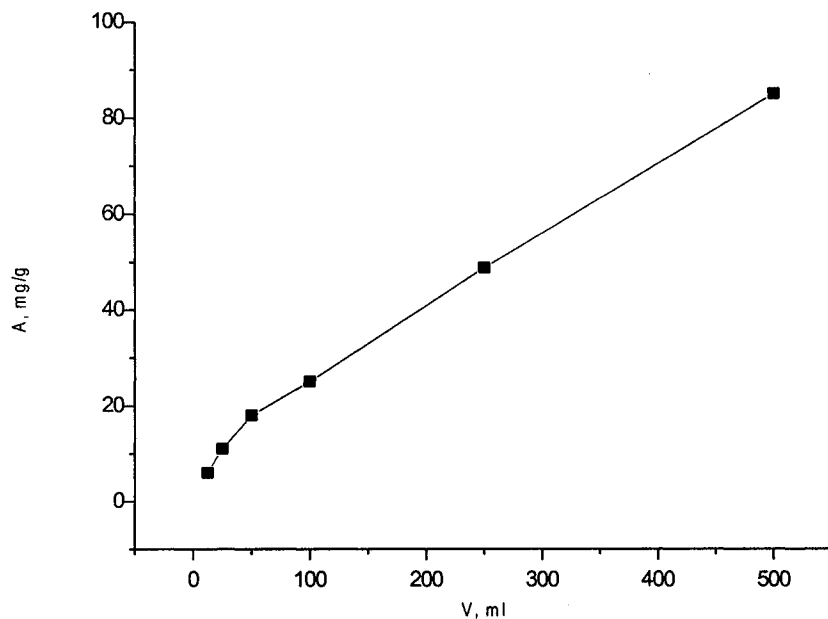


Fig.1. The influence of S:L on the adsorption of the trypsin by carbon fabric.

Table2 .Sorptional ability of carbon materials to cholera vibrio (concentration 10000 microbe b./ml).

Sorbent	Content of Cu(11), mg/g	S:L	Contact time, min	Sorption ability, %
Carbon fabric	-	1:50	5	60
	1,0		5	70
	1,3		5	95
	2,3		5	100
	4,0		5	100
Carbon felt (activat.)	-	1:100	5	0
			60	0
	3,9		5	75
			60	100