FILTER CONFIGURATIONS USED TO ADSORBE ORGANICS ONTO ACTIVATED CARBON CLOTH

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Introduction

Recently, new formulation of activated carbon has been developed : activated carbon cloth (ACC). It is produced from natural or synthetic precursor after a carbonization and activation step. Then, a large specific area and micropore volume are developed [1-3]. Studies reported that activated carbon fibers showed higher adsorption capacity and transfert rate than granular activated carbon (GAC) in gazeous or aqueous phase [4, 5]. These porous materials seem to be very promising adsorbants. To date, FAC, arranged as a cloth, has not been engineered in industrial processes.

The objective of this work is to present and describe different kinds of filters packed by activated carbon cloths. They are studied in dynamic systems. Head losses and adsorption performances against organics present in air or in water were determined as a function of velocities. Modelizations of phenomena were proposed.

Experimental

Characteristics of cloth and activated carbon cloth are presented in Table 1.

Commercial name	Actitex satin 8	Actitex CS 1501
Origin	Viscose	Viscose
Fiber diameter (µm)	10	10
Porosity	no porous	microporous
Pore diameter (A)	-	6.9
Micropore volume (%)	-	96.3
Surface area (m^2/g)	5 - 10	1689

Table 1. Characteristics of activated carbon cloth

Different kinds of filters were designed for adsorption processes. Headlosses were determined as a function of water velocity.

Results and Discussion

Activated Carbon cloth configuration

Figures 1 and 2 give some possibilities designs of ACC Filters

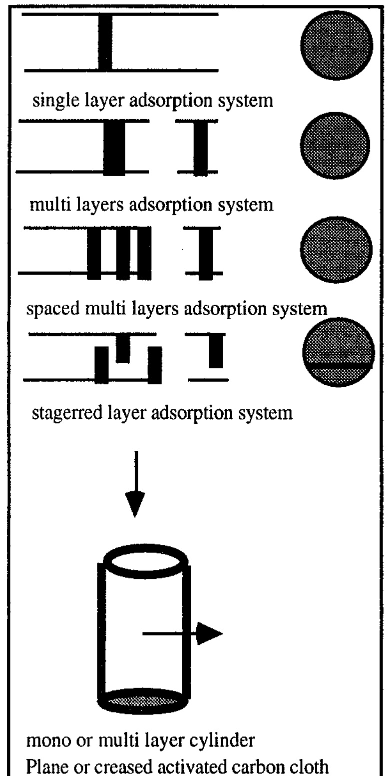

Figure 1 : ACC configurations with normal flow to the cloth or felt

Pressure drop

Figure 3 compares pressure drops as a function of water velocities through one cloth thickness of sample ACF as-received and activated. This figure shows that activation induces a decrease of pressure drops in the cloth. During activation volatil materials are removed and fiber size decreases. This decrease of size appears clearly on SEM pictures.

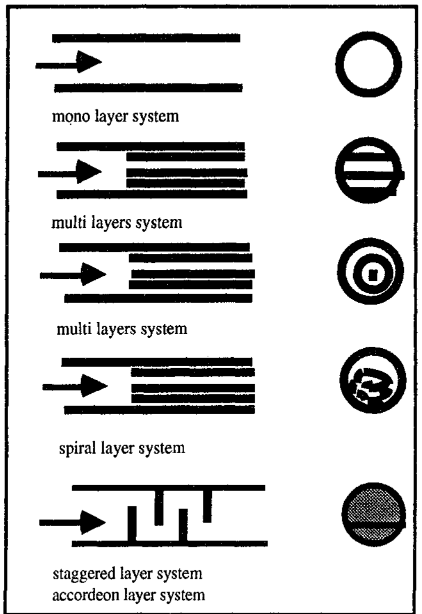

Figure 2 : Utilisations of ACF in water treatment processes, with flow tangential to the cloth or felt

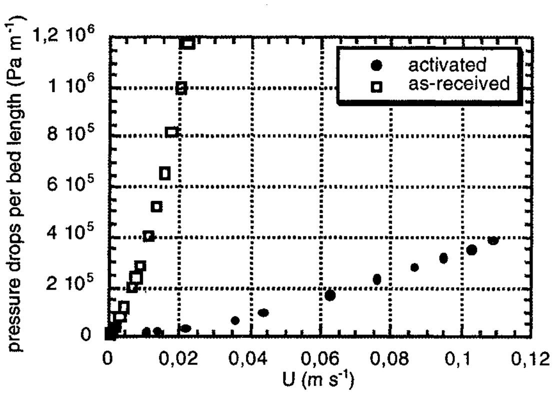

Figure 3 : Influence of activation on the water flow pressure drops in one thikcness of the sample ACF

Several cloth layers can be held in the disk to study the influence of the bed length. Comparison of pressure drops of water flow for 1 and 2 layers, with no distance between two cloth layers, gives equal pressure drops per unit length . It means that head losses are additive.

The influence of the distance between two cloth layers is not really marked for low water velocities. Perhaps it is due to the fact that the character of water flow in the tube is between laminar and turbulent. Then, a velocity perturbation created by the space between two layers will happen only for the highest water velocities (> 0.05 m s^{-1}). For water velocities higher than 0.05 m s^{-1}, the pressure drops increase with the distance between layers. By increasing more this distance, we may assume that the perturbation would decrease and the influence on pressure drops would be lower.
the following equation established for compacted chips bed was used [6] :

$$\frac{\Delta P}{H} = 2\gamma\tau^2\eta a_{vd}^2 \frac{(1-\varepsilon)^2}{\varepsilon^3} U + 0.0968\,\tau^3 \rho a_{vd} \frac{(1-\varepsilon)}{\varepsilon^3} U^2$$

where γ is a pore shape coefficient (here, γ=1), τ the tortuosity, a_{vd} the dynamic surface area seen by the flow (m^{-1}), η the fluid viscosity (Pl), ρ the fluid density (kg m^{-3}), ε the bed porosity, H the bed length (m) and U the fluid velocity (m s^{-1}).

Conclusions

This study gives the following conclusions :
- Different ACC configurations can be designed.
- Pressure drop were measured for some configurations.
- Model was usefull to calculate the pressure drops.

Acknowledgments

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