

EFFICIENCY OF LINEAR ALKYL BENZENES SULFONATION DEPENDING ON THE REACTOR CONSTRUCTION

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Linear alkylbenzene sulfonates (LABS) are the main component of the production of synthetic detergents obtained by sulfonation of linear alkylbenzene (LAB) in a multitube film reactor. The design of the reactor is 120 tubes with a diameter of 25 mm and a length of 6 m. A thin LAB film is fed through a switchgear and flows down the walls of the tube space under the action of gravity and the resistance force exerted by the gas mixture supplied from above the reactor. Due to adverse reactions, a highly viscous component consisting of tetralines and sulfones is formed. Its accumulation violates the uniformity of the film flow and prevents the diffusion of sulfuric anhydride into the organic phase, decreasing the quality of the products obtained [1, 2].

The purpose of the work is to determine the optimal design and technological mode of operation of a film reactor for sulfonation of linear alkylbenzenes. To do this, we use the long-term data on industrial operation and mathematical modeling method. The developed model includes the equations of material and heat balance of a sulfonation reactor. In accordance with the assumptions used, the sulfonation reactor model is:

$$G \frac{\partial C_i}{\partial Z} + G \frac{\partial C_i}{\partial V} = \sum_j W_j \cdot a_j$$

$$G \frac{\partial T}{\partial Z} + G \frac{\partial T}{\partial V} = \frac{1}{C_p} \sum_j W_j \cdot (-\Delta H_j) \cdot a_j$$

$$Z=0, C_i = C_i^{\text{in}}, T = T^{\text{in}};$$

$$V=0, C_i = C_i^{\text{in}}, T = T^{\text{in}}.$$

Initial conditions: $Z=0, C_{v.c.} = 0, \delta = 1$.

Here activity of the reaction mixture is: $a_j = e^{\delta C_{v.c.}}$.

The film thickness in the model:

$$r = \frac{\left(\frac{\pi d^2}{4} - \frac{\pi (d-2\delta)^2}{4} \right) \cdot n \cdot L}{V_{\text{liquid}}}$$

When creating the mathematical model, the following assumptions and assumptions were made:

- liquid droplets do not get into the gas or gas bubbles in the liquid film;
- fully developed film (effects of entry and exit into the reactor are not taken into account);
- the liquid film is symmetrical about the axis of the reactor;
- there are no radial gradients of temperature and concentration;
- deactivation of the reacting mixture occurs due to the formation of a viscous component, which inversely affects the reaction rate constants.
- astronomical time is discarded in favor of the volume of raw materials processed during the time between flushing the reactor.

To study the influence of the reactor design on the yield of the target product and the dynamics of the accumulation of a highly viscous component, a single cycle was calculated with varying structural parameters. Table 1 shows the values of the contact time and the Reynolds criterion of the film of flowing liquid for a reactor with different diameters and number of tubes. As a result of the calculations using the mathematical model, the dependence of the concentration of ASA and the highly viscous component in the output stream is obtained.

Thus, the dependence of the cycle duration on the reactor design parameters was revealed. As the diameter of the tubes increases, the mass transfer coefficient increases, the formation of an unsulfonated matter in favor of the formation of the target product decreases, which helps to reduce the accumulation of a highly viscous component.

With the number of tubes $n=40$, the diameter of the tubes $d=43$ mm, the length of the tube $L=6$ m, a decrease in the formation of a viscous component is observed without deterioration in the quality of the obtained ASA.

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References

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INFLUENCE OF GRAMICIDIN S AND β -CYCLODEXTRIN COMPLEXATION TECHNIQUES ON THE DRUG RELEASE

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Gramicidin S is an antimicrobial peptide known worldwide since 1942 and clinically applied since 1944 [1].

Recently proved mechanism of the antimicrobial activity of Gramicidin S reveals its benefit comparing to the conventional antibiotics which reflects in low inhibitory and bactericidal concentrations.

The discovered mechanism also explains the long clinical practice with a lack of resistance to the antibiotic among most known microorganisms [2].

Besides its high effectiveness against gram-positive microorganisms, Gramicidin S demonstrates high antimicrobial activity towards to gram-negative bacteria and also some fungi which makes it possible to be applied for infection treatment [3].

However, due to its high hemotoxicity, the antibiotic is only administered orally or topically and manufactured predominantly in solid dosage form as tablet, which limits peptide effectiveness due to low bioavailability caused by low water solubility of the drug.

In present work the attempt had been made to increase the solubility of gramicidin S via complex formation with β -cyclodextrin using different complexation techniques.

Cyclodextrins are the starch derivatives discovered in 1891 and widely used in pharmaceutical industry in many purposes, which is possible due to the specific structure of cyclodextrins.

The manufacturing technology provides polysaccharides with the cone shape with a hydrophobic inner cavity and hydrophilic surface. This type of structure lets cyclodextrins incorporate hydrophobic molecules or the most hydrophobic parts of those [4].

That specific property of cyclodextrins is widely applied in pharmacy to modify the drug release, mask negative organoleptic properties as well as to improve its solubility in water.

Among those, β -cyclodextrin is the most used agent due to its low price, availability on the market and regulatory status: it is described in EP, USP and JP monographs.

β -cyclodextrin had been studied clinically and finds its application as drug excipient for different dosage forms either via inclusion complex formation or in an uncomplexed state [5].

The aim of the present work was to study the influence of β -cyclodextrin on gramicidin S properties via inclusion complex formation as following.

Antibiotic inclusion complexes were formed applying different methods of complex formation such as: co-precipitation, paste complexation and dry mixing.

The Gramicidin S: β -cyclodextrin ratio was taken as 1 : 10. The resulting powders were dried in convector to remove the residual solvent and uniformed to reach the particle size not more than 0.8 mm.

The *in vitro* release studies were performed in different pH (2.0, 4.3, 6.8) at 37°C and the drug concentration in buffer solution was detected using HPLC method.

It was found that gramicidin S complexation with β -cyclodextrin increases the drug solubility in water and provides sustained release of the peptide at pH=4.3 for at least 48 h.

However, there was almost no release at higher pH level while at pH=2.0 the burst release had been