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INVESTIGATIONS ON KINETICS OF CARBON DISULPHIDE SORPTION ON ANION EXCHANGERS

The effects of basic parameters of the process, i.e. concentration of carbon disulphide in gas, linear gas velocity, concentration of solution for regeneration of anion exchanger, spraying intensity, granulation, anion exchanger layer thickness, resistances of gas flow on the kinetics of CS_2 sorption on anion exchangers have been examined in installation operating on laboratory and quarter technical scales.

1. INTRODUCTION

A dynamic development of the industry of synthetic fibres, with the now reduced production of viscose fibres (ca 50% of a total production of all the kinds of artificial fibres) has become an essential reason of the increasing emission of highly toxic substances (H_2S and SO_2) to the atmosphere, observed in the recent years. Annual emission of those substances in Poland reaches about 18,000 tons [5]. The development of cheap and efficient methods of gas treatment meets, however, difficulties, chiefly because of low concentrations of both components in waste gases, and of large volumes of gases which are to be treated.

Of the numerous and well known methods for the removal of acidic gas pollutants from industrial waste gases the application of ion exchangers is more and more frequently suggested.

Numerous papers published in the recent decade have presented the results of the pre-liminary laboratory investigations on the sorption of acidic gases on anion exchangers [2–4], [6–8], [10], [11], [13–15]. In these publications, however, only the sorption capacity of anion exchanger has been determined, other parameters being not given. The effects of linear velocity of gas, anion exchanger layer thickness and of other parameters on the anion exchanger sorption capacity are not univocally interpreted by the authors. Hence, it may be inferred that the application of anion exchanger to the neutralization of waste gases depends on the progress in the studies on the kinetics of the sorption process of acidic gas pollutants.

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For the above reasons the investigations on the sorption of carbon disulphide was the following:

1. To determine empirical relations describing the effect of basic parameters (concentration of carbon disulphide in gas, linear velocity of gas, concentration and kind of the solution regenerating the anion exchanger, and the resistances of gas flows) on the kinetics of CS_2 sorption on anion exchangers.

2. To perform comparative investigations on CS_2 sorption on solid sorbents (active carbon and molecular sieves);

3. To check, on the installation operating on a quarter technical scale, whether the anion exchangers can be used in an industrial technology of CS_2 removal from waste gases.

2. EXPERIMENTAL PART
AND RESULTS OF INVESTIGATIONS

Experiments have been conducted on laboratory and quarter technical scales on gases artificially prepared and emitted by a viscose fibre plant, using the technique of a continuous regeneration of the anion exchanger layer with the solution of a sodium hydroxide during the process of sorption [4].

In the investigations we have used commercial anion exchangers (Amberlite, Dowex Lewatit, Wofafit, Zerolit) and synthetized ones (SNE, SHE, SHM and FFD) [9, 12].

2.1. LABORATORY SCALE OF THE CS_2 SORPTION ON ANION EXCHANGERS

Installation used in laboratory-scale investigations is presented schematically in fig. 1.

Sulphide dioxide from the gas washer *1* passed to the agitator *2*, where it was mixed with the air sucked from the ambient by the rotameter *3*. A part of the air flowing through the washer *1* which contained CS_2 batched from the distributor *4*, was measured with the measuring orifice plate *5*. The required emission of CS_2 vapours was obtained keeping a constant quantity of evaporated CS_2 due to suitable constant temperature in the thermostate *6*, and an adequate flow of air through the washer *1*. The mixture of air and CS_2 vapours was next introduced into the sorption column *7*, of the diameter 0.036 m, and treated on the sorbent bed *8*. Thereupon the gas passed to the vacuum pump *9*, whence it was discharged to the atmosphere. In case when the experiments were conducted with the sprinkling bed, the sprinkling solution was supplied from the tank *10* with the peristaltic pump *11* and sprinkling jet *12*. Dispersion of sprinkling solution was obtained by passing a part of gas from the system through the measuring orifice plate *13*. A solution trickling from the shelve was collected in the distributor *14*, whence it was periodically taken to the graduated glass *15*. Pressure drop in the sorption column was measured by the manometer *16*. The concentration of CS_2 in the gas before and after the column was determined colorimetrically by sucking a known quantity of gas with a micropump *17* through the washers *18* with the solution absorbing CS_2 (alcoholic solution of diethyloamine, triethylo-
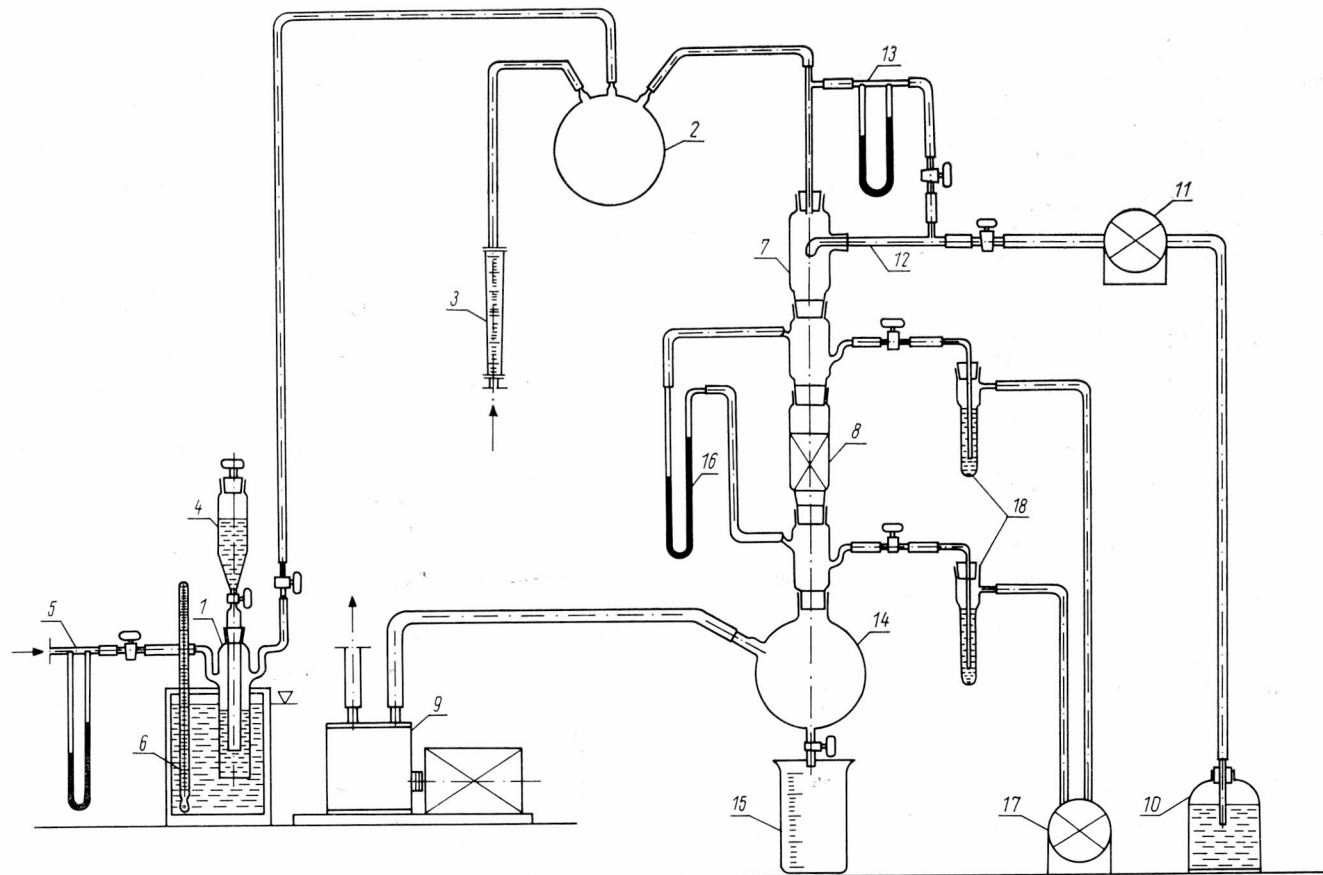
Fig. 1. Set-up of laboratory installation for CS_2 sorption

Rys. 1. Schemat instalacji laboratoryjnej do sorpcji dwusiarczku węgla

amine and copper acetate). Preliminary experiments allowed to select anion exchangers
with the best sorption and chemisorption properties with respect to CS_2, were used in
further investigations in order to determine basic parameters of the kinetics of CS_2 sorp-
tion of anion exchangers.

Within the examined range of variable parameters for the selected anion exchangers*
DOWEX 2 ×8, SNM and FFD the efficiency of sorption slightly decreased with the increas-
ing linear velocity of the gas. Starting from the value of 0.4 m/s it rapidly decreased. It has
been observed that this drop was higher for lower sprinkling intensities. This may be
explained by the drying of the anion exchanger layer with the increasing linear velocity of
the gas, thus by an insufficient regeneration of the anion exchanger and shorter contact
time between the gas and anion exchanger. The minimum time of gas-anion exchanger
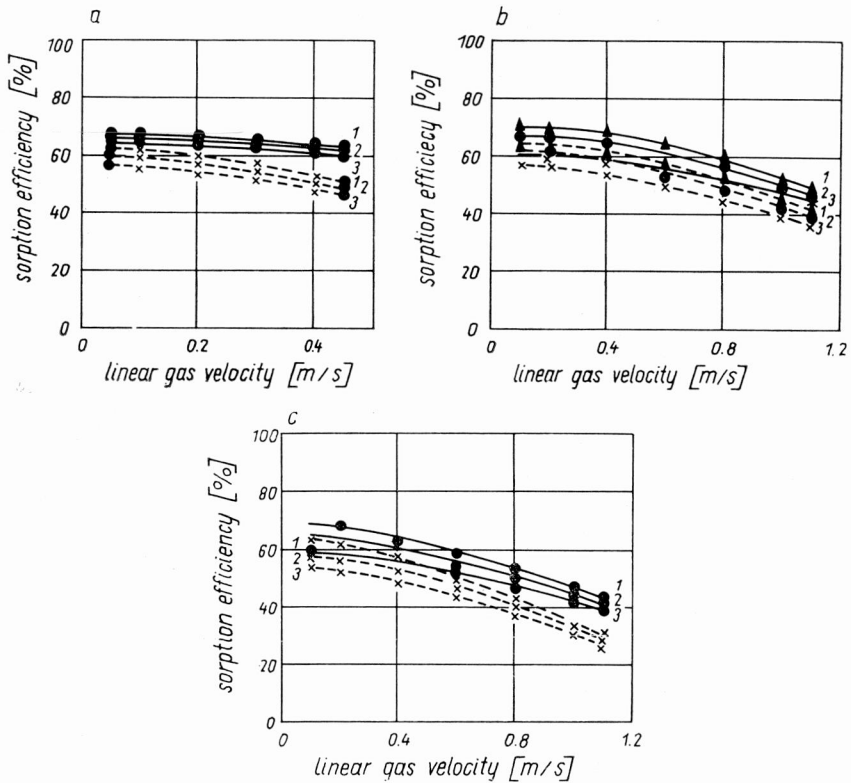DOWEX 2 ×8 contact was 0.075 s and on the anion exchangers SNM and FFD this time

Fig. 2. CS_2 concentration in gas vs. sorption efficiency for the selected anion exchangers, at a constant
initial concentration of gas c_0: $1 - 0.8$ g/m³, $2 - 0.19$ g/m³, $3 - 0.35$ g/m³

a) $- q_1 = 2.60 \times 10^{-7}$ m³/s, $---q_2 = 0.45 \times 10^{-7}$ m³/s,   DOWEX 2 × 8 $- 0.015$ m,   b) $- q_1 = 5.65 \times 10^{-7}$ m³/s,
$---q_2 = 1.30 \times 10^{-7}$ m³/s, SNM $- 0.03$ m, c) $- q_1 = 5.65 \times 10^{-7}$ m³/s, $---q_2 = 1.30 \times 10^{-7}$ m³/s, FFD $- 0.03$ m

Rys. 2. Wpływ stężenia CS_2 w gazie na efektywność sorpcji dla wybranych anionitów, przy stałym stężeniu
początkowym gazu c_0:$1 - 0.08$ g/m³, $2 - 0.19$ g/m³, $3 - 0.35$ g/m³

* The selected anion exchangers, i.e. strongly basic: DOWEX 2 × 8 and SNM, and feebly basic FFD.

amounted to 0.125 s and 0.15 s for sprinkling intensities 0.45×10^{-7} m³/s and higher than $1.3 \cdot 10^{-7}$ m³/s, respectively. The reduction of contact time below these value distinctly deteriorates working sorption capacity of anion exchangers.

From the graphs representing the dependence of sorption efficiency on linear velocity of gas and on the CS_2 concentration in gas (fig. 2) it follows that the sorption efficiency decrease nonlinearly with the increasing linear velocity of gas, at constant initial concentration of CS_2 in gas and constant sprinkling intensity. In the course of experiment no significant differences in the shape of curves representing the dependence of sorption efficiency on the CS_2 concentration in gas have been observed. The graph presented in fig. 3 allows to determine for separate anion exchangers limiting values of the CS_2 concentrations above which any visible effect of CS_2 concentrations in gas on the kinetics of sorption process cannot be observed.
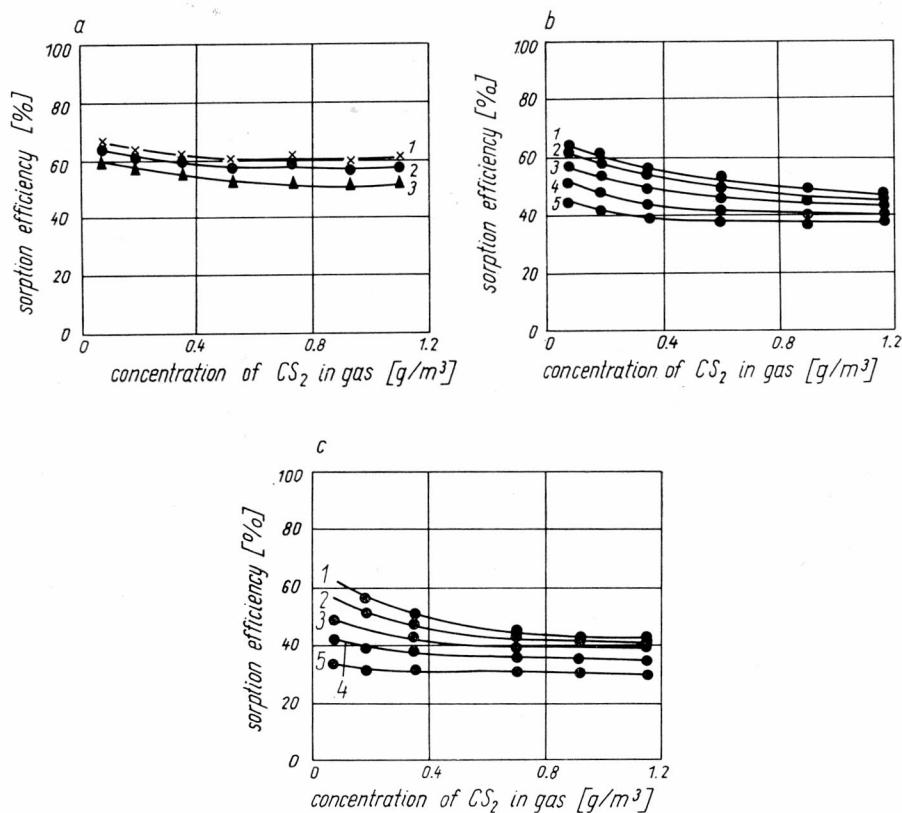

Fig. 3. Sorption efficiency vs. concentration of CS_2 in gas for different linear velocities of gas on the anion exchangers DOWEX 2×8, SNM, FFD, at constant sprinkling intensity $q = 1.3 \times 10^{-7}$ m³/s

a) $1 - w_0 = 0.05$ m/s, $2 - w_0 = 0.20$ m/s, $3 - w_0 = 0.40$ m/s,   DOWEX $2 \times 8 - 0.015$ m,   b) $1 - w_0 = 0.2$ m/s, $2 - w_0 = 0.4$m/s, $3 - w_0 = 0.6$m/s, $4 - w_0 = 0.8$m/s, $5 - w_0 = 1.0$m/s,   SNM $- 0.03$m   c) $1 - w_0 = 0.2$m/s, $2 - w_0 = 0.4$ m/s, $3 - w_0 = 0.6$ m/s, $4 - w_0 = 0.8$ m/s, $5 - w_0 = 1.0$ m/s,   FFD $- 0.03$ m

Rys. 3. Zależność efektywności sorpcji od stężenia CS_2 w gazie dla różnych prędkości liniowych gazu na anionicie DOWEX 2×8, SNM, FFD, przy stałym natężeniu zraszania $2 = 1.3 \times 10^{-7}$ m³/s

The influence of the concentration of CS_2 in gas on the efficiency of sorption on the anionite DOWEX 2×8 is observed up to 0.55 g of CS_2/m^3, on the anionite SNM up to 0.5 g of CS_2/m^3, and on the anionite FFD up to 0.4 g of CS_2/m^3.

The analysis of the relations presented in fig. 4 allowed to state that the concentration of NaOH in sprinkling solution increasing above 5% practically has no effect on the increase in sorption efficiency of CS_2 on the anion exchangers examined. On the other hand, a non-linear growth in sorption efficiency took place with the increasing intensity of

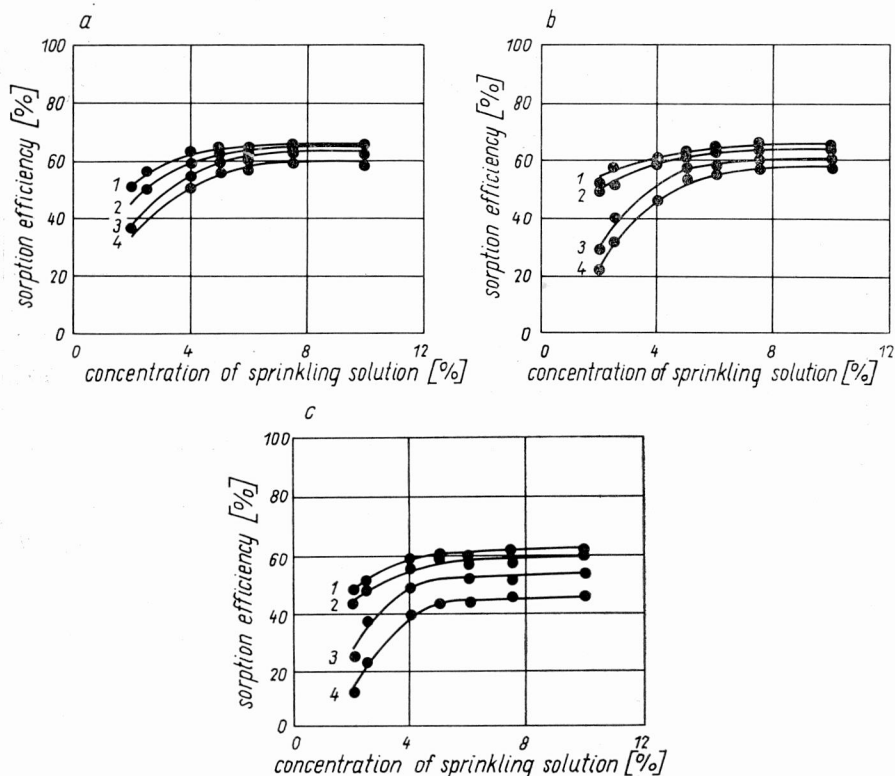Fig. 4. Concentration of sprinkling solution vs. efficiency of CS_2 sorption on the anion exchangers DOWEX 2×8, SNM, and FFD, at constant initial gas concentration $c_0 = 0.19$ g/m^3

a) $1 - q_1 = 2.60 \times 10^{-7}$ m^3/s, $\quad$ $2 - q_2 = 1.30 \times 10^{-7}$ m^3/s, $\quad$ $3 - q_3 = 0.89 \times 10^{-7}$ m^3/s, $\quad$ $4 - q_4 = 0.46 \times 10^{-7}$ m^3/s; DOWEX $2 \times 8 - 0.015$ m, $\quad$ b) $1 - q_1 = 5.65 \times 10^{-7}$ m^3/s, $\quad$ $2 - q_2 = 4.24 \times 10^{-7}$ m^3/s, $\quad$ $3 - q_3 = 1.30 \times 10^{-7}$ m^3/s, $4 - q_4 = 0.89 \times 10^{-7}$ m^3/s; SNM $- 0.03$ m, $\quad$ c) $1 - q_1 = 5.65 \times 10^{-7}$ m^3/s, $\quad$ $2 - q_2 = 4.24 \times 10^{-7}$ m^3/s, $\quad$ $3 - q_3 = 1.30 \times 10^{-7}$ m^3/s, $\quad$ $4 - q_4 = 0.89 \times 10^{-7}$ m^3/s, $w_0 = 0.4$ m/s; FFD $- 0.03$ m

Rys. 4. Wpływ stężenia roztworu zraszającego na efektywność sorpcji CS_2 na anionicie DOWEX 2×8, SNM i FFD, przy stałym stężeniu początkowym gazu $c_0 = 0.19$ g/m^3

sprinkling, and the limiting values above which the sorption intensity keeps constant value amounted to 1.3×10^{-7} m^3/s and 4.2×10^{-7} m^3/s for the anion exchanger DOWEX 2×8 and the anionites SNM and FFD, respectively.

From the analysis of the dependence of flow resistances on linear velocity of gases at varying sprinkling intensities and anion exchanger layer thicknesses it has been found

that within the examined range of variable parameters, the anion exchanger FFD — despite lower efficiency of sorption — displays the best motion parameters, which affect the economics of installation for the treatment of waste gases.

Low resistance of gas flow and the fact that any quantities of the anion exchanger FFD of a different granulation may be readily synthesized under laboratory conditions, have decided upon the choice of this anion exchanger for further investigations conducted on a quarter technical scale on the sorption of CS_2 on gases emitted by the plant producing artificial fibres by viscose method.

2.2 SORPTION OF CS_2 ON THE ANION EXCHANGER FFD ON A QUARTER TECHNICAL SCALE

The experiment in this series of investigations was conducted on the installation presented schematically in fig. 5. Gas polluted with H_2S and CS_2 was supplied by the pipe *1* to the sorption column *2* of the diameter 0.23, where two layers of anion exchanger *4* were placed
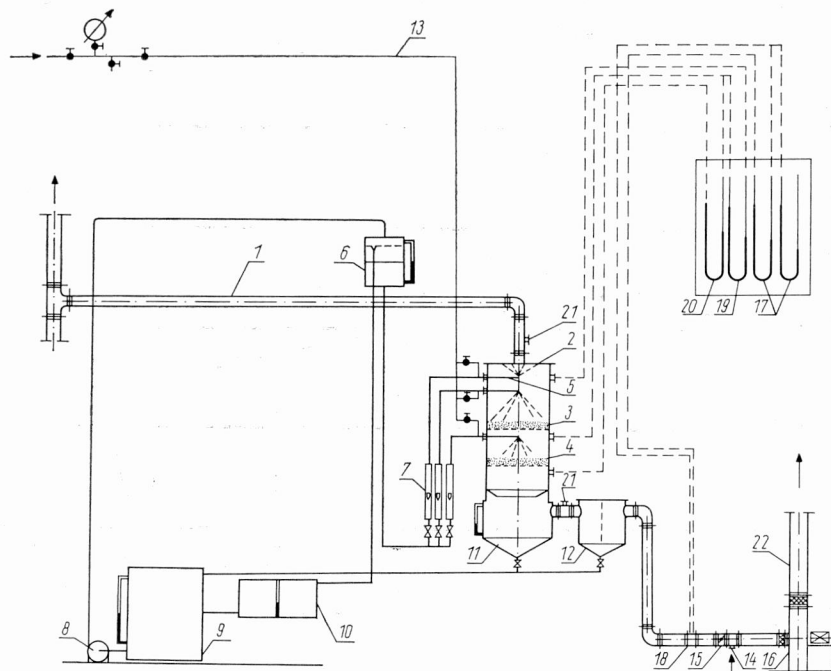

Fig. 5. Set-up of experimental installation for CS_2 and H_2S sorption on a quarter technical scale

Rys. 5. Schemat instalacji doświadczalnej do sorpcji CS_2 i H_2S w skali ćwierćtechnicznej

on the shelves *3*. The solution of sodium hydroxide flowing down hydrostatically from the upper tank *6* through the rotameters was sprinkled by jets *5* during the sorption. The tank *7* was filled by the pump *8* with the solution from the tank *9* and from the intermediate tank *10* to which post-sorption solutions flew from the lower part of the column *11* and condeser *12*. Sprinkling of sodium hydroxide was obtained by supplying a known quantity of com-

pressed air through a conduit *13* to jets. The flow of gases through the sorption column was controlled by means of a waste gate *14* with the valve *15* placed in the pipe connecting the fan *16* with the column and condenser. The intensity of gas flow was indicated by manometric *U*-pipes *17* connected with the measuring orifice plate *18*. Concentrations of H_2S and CS_2 before and after the sorption column *21* were determined by using an analysing set. This set consisted of micropumps sucking the gas and washers with solutions absorbing H_2S (solution of cadmium acetate) and CS_2 (alcoholic solution of diethyleamine and copper acetate). The purified gases were discharged to the atmosphere by the pressure conduit *22* of the fan *16*. The resistances of gas flow through the sorption column were read on a liquid-column manometers *19* and *20* at every 600 s. After the experiment was finished the mean flow resistance for a given series was computed.

In all the earlier experiments on the sorption of CS_2, gases were passed through one layer of the anion exchanger. On the basis of theoretical analysis of the results it may be expected that some parameters of the process will be improved if the sorption is conducted on two or more layers of the anion exchanger.
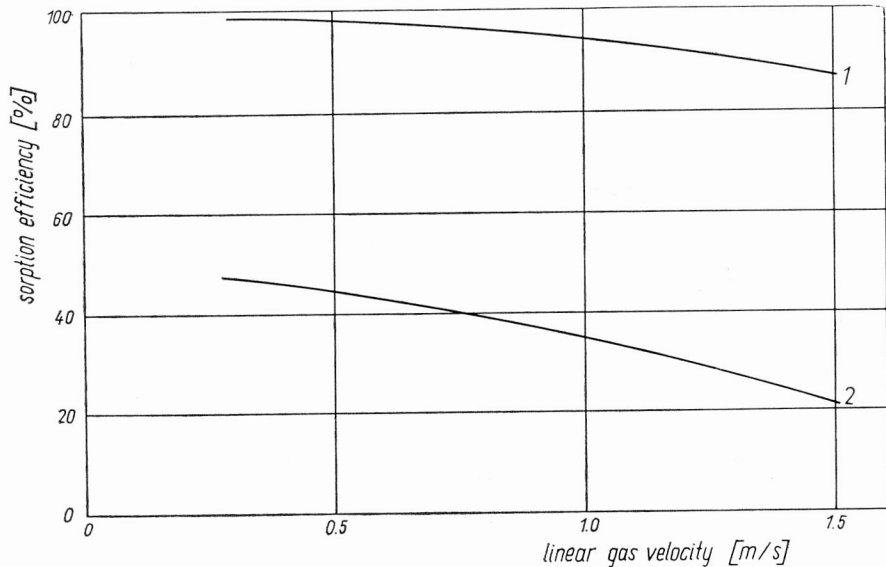

Fig. 6. Efficiency of H_2S and CS_2 sorption on the anion exchanger FFD, the thickness of the layer = 0.06 m, vs. linear velocity of gas

1 — H_2S, *2* — CS_2

Rys. 6. Zależność efektywności sorpcji H_2S i CS_2 na anionicie FFD o wysokości warstwy 0,06 m od prędkości liniowej gazu

From the graphs in figs 6 and 7 representing the efficiency of H_2O and CS_2 sorption on the 0.06 m layer of the anion exchanger FFD and on two 0.03 m layers of the anion exchanger FFD, as a function of the linear velocity of gas at a constant sprinkling intensity, it may be seen that the efficiency of CS_2 sorption distinctly increases at the gas flowing through two layers of the anion exchanger. Within the examined range of linear velocities

of gas an essential improvement has been also observed in the efficiency of H_2S sorption on two layers of the anion exchanger. Up to the linear velocity of gas equal to 0.9 m/s, H_2S was completely removed from the gas mixture; with the increasing velocity up to 1.5 m/s the efflciency of H_2S sorption decreased to 96.1%.

Basing on the analysis of the results obtained in this series of investigations it may be stated that the presence of H_2S in the mixture of gases decreases the efficiency of the sorption of CS_2 on the anion exchanger. The increased number of shelves with the anion-exchanger bed contributes to the higher efficiency of the CS_2 removal from waste gases. In the next series of investigations by applying the installation with two sorption columns connected in series it was intended to remove H_2S from the mixture of gases after the I stage of treatment, since it decreases the efficiency of CS_2 sorption on anion exchangers. The experimental data confirm the concept of two-stage treatment of the gaseous mixture of H_2S and CS_2 on the anion exchanger conducted on a quarter technical scale.
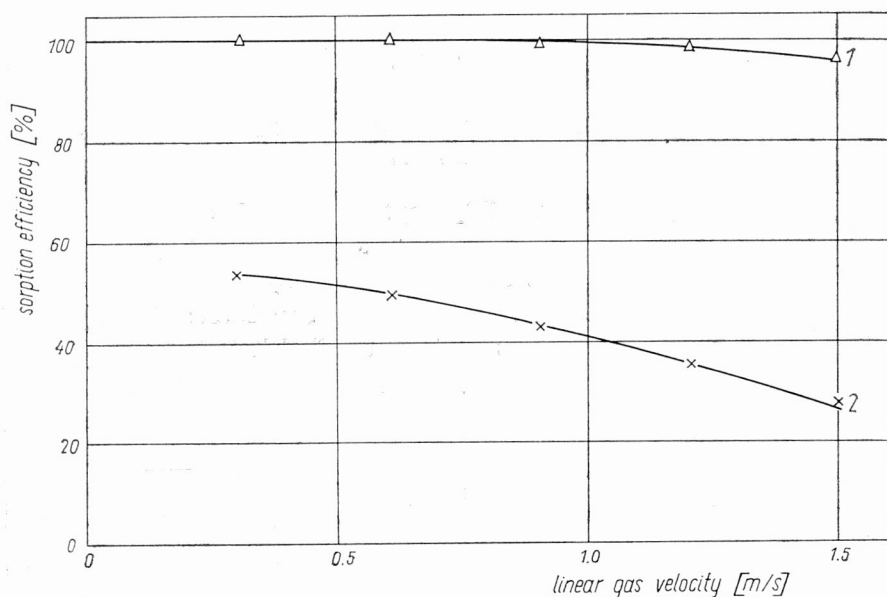

Fig. 7. Efficiency of H_2S and CS_2 sorption on the anion exchanger FFD with two layer (each 0.03 m thick) vs. linear velocity of gas

$1 - H_2S, \ 2 - CS_2$

Rys. 7. Zależność efektywności sorpcji H_2S i CS_2 na anionicie FFD o dwóch warstwach (każda po 0,03 m) od prędkości liniowej gazu

During the experiment a complete sorption of H_2S has been observed in the first stage of the treatment of gaseous mixture over the whole range of variable parameters. According to expectations in this conditions the efficiency of CS_2 sorption after the first sorption column was very low (of the order of several per cent). Low efficiences of CS_2 sorption were determined chiefly by high velocities of gas flow in the first sorption column, thus by very short contact time of gas and anion exchanger. Therefore for further investiga-

tions of CS_2 sorption on a quarter technical scale only the results obtained at the second treatment stage of the mixture of gaseous CS_2 and H_2S have been taken into account, considering the first stage of treatment as the preliminary step in a total removal of H_2S from the system investigated.

In the course of experiments a rapid drop in the efficiency of CS_2 sorption was observed for contact times shorter than 0.15 s, and a distinct influence of sprinkling intensity on the kinetics of CS_2 sorption on the anion exchanger FFD. A characteristic break-down has been observed in a curve representing the dependence of sorption efficiency on sprinkling density at constant linear velocity of gas. The increasing sprinkling density above $0.5 \ m^3/m^2$ h does not result in a significant increase in the efficiency of CS_2 sorption.

It has been stated, moreover, that by increasing the scale of experiments the shapes of curves for the dependence of sorption efficiency on the concentration of CS_2 in gas and on the linear velocity of gas, as well as for the dependence of sorption efficiency on the concentration of NaOH solution sprinkling the anion exchanger, remained unchanged.

Under experimental conditions resistances of gas flow on sorption columns did not exceed the value of $3 \times 10^3 \ N/m^2$ — assumed as a limiting value in industrial scale.

2.3. COMPARATIVE INVESTIGATIONS OF THE KINETICS OF CS_2 SORPTION ON SOLID SORBENTS

In order to compare the results for CS_2 sorption on solid sorbents with its sorption on anion exchangers the investigations were conducted on a laboratory scale in a dynamic system, by the method of output curves determining i.e. by increasing the concentration of CS_2 after the anion exchanger layer, on the active carbon Carbosorbid T, on molecular sieves 5A and on the strongly basic anion exchanger DOWEX 2×8.
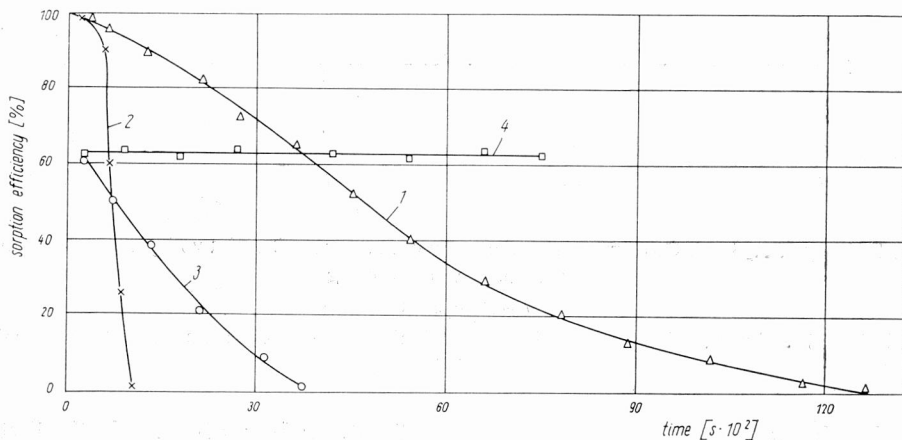

Fig. 8. Efficiency of CS_2 sorption vs. duration of sorption for different sorbents

1 — activated carbon,   2 — molecular sieve 5A,   3 — DOWEX 2×8,   pH > 7,   4 — DOWEX 2×8,   sprinkled by 5% NaOH $c_0 = 0.35$ g/m³, $w_0 = 0.4$ m/s; $m = 20$ g, $q = 1.3 \times 10^{-7}$ m³/s

Rys. 8. Zależność efektywności sorpcji CS_2 od czasu trwania procesu sorpcji dla różnych sorbentów

1 — węgiel aktywny,   2 — sita molekularne 5A,   3 — DOWEX 2×8,   pH > 7,   4 — DOWEX 2×8,   zroszony 5% NaOH, $c_0 = 0.35$ g/m³, $w_0 = 0.4$ m/s, $m = 20$ g, $q = 1.3 \times 10^{-7}$ m³/s

From the graphs representing the dependence of sorption efficiency on the duration of sorption (fig. 8) it is seen that the removal of CS_2 from the air on an active carbon and on molecular sieves takes place until sorption capacity of the sorbent bed is exhausted, whereas sorption capacity of the anion exchanger remains practically time invariant, at a constant sprinkling intensity of the anion-exchanger bed.

Thus, it may be stated that anion exchangers — despite the fact that their efficiency of CS_2 sorption in the initial period of sorption process is lower than that of an activated carbon and molecular sieves — can be used for the removal of CS_2 from the air, although the obtained efficiency of CS_2 sorption does not solve completely the problem of environment protection in the neighbourhood of the plants of viscose fibres.

2.4. THE EFFECT OF THE STRUCTURE OF ANION EXCHANGER ON THE KINETICS OF CS_2 SORPTION

Comparative investigations on CS_2 sorption conducted under identical conditions on the anion exchanger and on the polyester granulate have confirmed the essential role of the anion exchanger in sorption process (the efficiencies of CS_2 sorption on the anion exchanger were higher by about 40 %). A detailed analysis of the results obtained allows, moreover, to determine the influence of the anion exchanger structure on the kinetics of CS_2 sorption. It has been found that strongly basic macroporous anion exchangers have better sorptive properties with respect to CS_2 than microporous anion exchangers. The alkalinity of the anion exchanger and the size of its pores affect also the course of CS_2 sorption. It has been found that on strongly basic macroporous anion exchangers the sorption is better than on weakly basic macroporous anion exchangers, of which those with pores of the order 0.03–0.6 mm showed better sorptive properties, when compared with the anion exchangers with pores of the order 0.01–0.08 mm.

From the results of investigations on CS_2 sorption on the anion exchanger of different exchanging capacity it follows that a macroporous anion exchanger with a higher exchanging capacity is a much better sorbent of GS_2 than a similar macroporous anionite with a lower exchanging capacity. On the other hand, the increasing granulation of the anion exchanger at a constant sprinkling intensity results in the drop of the efficiency of CS_2 sorption.

CONCLUSIONS

Summing up it should be stated that the conducted investigations on the kinetics of CS_2 sorption on anion exchangers, having in mind practical applications in the technology of waste gases treatment, are an essential complement to the existing information on the kinetics of the gas sorption on anion exchangers.

The experiments performed allow to formulate the following conclusions:

1. Application of anion exchanger in a quarter technical installation under continuous operation conditions allowed to remove completely H_2S from the gas treated, while the

obtained 50 % efficiency of CS_2 sorption at linear velocity of gas 0.6 m/s and at sprinkling intensity 0.5 m³/m²h is unsatisfactory from the viewpoint of natural environment protection.

2. Investigations on the kinetics of CS_2 sorption on anion exchangers, conducted in laboratory and quarter technical scales have shown that the anion exchangers can be applied as active sorbents to the removal of CS_2 from waste gases, provided that sorbents with properties resembling the anion exchanger DOWEX 2×8 and granulation $(2-3)\times 10^{-3}$m will be available in the nearest future.

3. Comparative investigations on CS_2 sorption on solid sorbents and anion exchangers allow to state that anion exchangers are characterized by better sorptive properties with respect to CS_2 than molecular sieves or an activated carbon, and that they display at the same time a high tolerance to the variations in CS_2 concentrations in the gas treated.

4. A continuous regeneration of the anion exchanger layer with the solution of NaOH during the sorption of CS_2 on anion exchangers allowed to multiply its sorption capacity. The sorption capacity of the anion exchanger remains practically unchanged during the process, at a constant intensity of the anion exchanger layer sprinkling with the solution of NaOH, and at a constant linear velocity of gas.

5. From the conducted investigations on the effect of basic parameters of sorption process (concentration of CS_2 in gas, linear velocity of gas, concentration and kind of the solution regenerating the anion exchanger, sprinkling intesity, granulation, thickness of anion exchanger layer, and resistances of gas flow) on the kinetics of CS_2 sorption on anion exchangers it follows that these parameters are different at an increased scale of experiments.

6. Results of investigations on the effect of the structure of different kinds of anion exchangers on the CS_2 sorption allow to state that of the anion exchangers examined the best sorptive properties with respect to CS_2 have strongly basic macroporous anion exchangers. It seems that the application of strongly basic anion exchangers with an adequate granulation, and the choice of optimal operation parameters for the treatment plant will allow to obtain in the nearest future satisfactory results in the treatment of waste gases from viscose fibres plants, at relatively low inital and operational costs.

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BADANIA KINETYKI SORPCJI DWUSIARCZKU WĘGLA NA ANIONITACH

W warunkach pracy instalacji laboratoryjnej i ćwierćtechnicznej zbadano wpływ podstawowych parametrów procesu, takich jak: stężenie dwusiarczku węgla w gazie, prędkość liniowa gazu, stężenie roztworu regenerującego anionit, natężenie zraszania, granulacja, wysokość warstwy anionitu i opory przepływu gazu, na kinetykę sorpcji CS$_2$ na anionitach. Określono również wpływ struktury anionitu na kinetykę procesu sorpcji.

UNTERSUCHUNGEN ZUR SORPTIONSKINETIK
DES KOHLENSTOFFDISULFIDS MITTELS ANIONENAUSTAUSCHERN

An Versuchsinstallationen im Labor- und im Vierteltechnischen Maßstab, hat man nach dem Einfluß grundlegender Parameter auf die Kinetik der CS$_2$-Sorption geforscht. Zur Menge von Parametern wurden folgende eingereiht:
— die CS$_2$-Konzentration im Gas,
— die lineare Gasgeschwindigkeit,
— die Konzentration der zur Regeneration der Anionite benutzten Lösung,
— die Berieselungsdichte,
— die Granulation und Schütthöhe des Austauscherbetts,
— der Durchflußwiderstand des Gases.
Erforscht wurde auch der Einfluß der Struktur der Anionenaustauschern auf die Kinetik des Sorptionsprozesses.

ИССЛЕДОВАНИЕ КИНЕТИКИ СОРБЦИИ СЕРНИСТОГО УГЛЕРОДА НА АНИОНИТАХ

В условиях работы лабораторной и четвертьтехнической установок исследовано влияние таких основных параметров процесса, как концентрация сернистого углерода в газе, линейная скорость газа, концентрация раствора, восстанавливающего анионит, интенсивность смачивания, грануляция, высота слоя анионита и сопротивление течению газа, на кинетику сорбции CS$_2$ на анионитах. Определено также влияние структуры анионита на кинетику процесса сорбции.