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EFFECTS OF THE RELATIVE HUMIDITY OF ATMOSPHERE ON PERFORMANCE OF *n*-HEXANE VAPORS ADSORPTION UNDER STATIC CONDITIONS

BY

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Abstract. Although activated carbon has been widely used as adsorbents for volatile organic compounds (VOCs), it frequently encounters some problems like fire risk and pore blocking, its hygroscopicity and preference for adsorbing water vapor which leads to a decrease in the retention of VOCs vapors and increasing the amount of water co-desorbed in the regeneration stage. Here, two hypercrosslinked polymeric resins, MN 202 and MN 250 were successfully tested for *n*-hexane vapors adsorption under static conditions for a concentration range between 9200 ppm and 46050 ppm. The performances of *n*-hexane vapors adsorption, expressed by removal efficiency (R , %) and adsorption capacities (q , mg/g) recorded by MN 202 and MN 250 were compared with those recorded by the granular activated carbon AC 20 (GAC-AC 20) tested in the same conditions and it turned out that $MN\ 250 > AC\ 20 > MN\ 202$. Besides, the adsorption performances of *n*-hexane vapors by the three adsorbents, were investigated at different humidities, RH , from 33% to 97% and the results showed that the polymeric resins behaved much better in high humidity environment. When the RH increased from 33% to 97% and the *n*-hexane vapors concentration varied in the range 9200 ppm to 46050 ppm, the efficiencies of *n*-hexane removal (R , %) decrease for each adsorbents thus: by 13% to 40% for AC 20, by 15% to 25% for

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MN 202 and by 6% to 10% for MN 250. Therefore, MN 202 and especially MN 250 are promising adsorbents for VOCs removal.

Keywords: adsorption, *n*-hexane vapor, relative humidity, VOCs, hypercrosslinked polymeric resins, activated carbon.

1. Introduction

Volatile organic compounds (VOCs) are one of the major air pollutants and include any organic compound that has a boiling point lower than 250°C at atmospheric pressure. It is estimated that 6247 Gg of VOCs were released in EU in 2020 of which the most important contribution is from manufacturing and extractive industry with 2945 Gg (47%), especially from paints and solvents production and use accounting for 30% of total emissions of VOCs at EU level, followed by agriculture sector like livestock and crops with 1701 Gg (27%), road transport with 496 Gg (7%) and energy production and distribution sector with 188 Gg (6%) (EEA Report, 2022).

VOCs include thousands of compounds with different toxicity and reactivity. In the presence of sunlight illumination these can chemically interact with other atmospheric pollutants as OH radicals, NO_x or other oxidizing substances and can form secondary air pollutants such as tropospheric ozone (O₃), peroxyacetyl nitrate (PAN) and secondary organic aerosols (SOAs). So this aspect leads to environmental hazards endangering the health of human beings (e.g. cancer, leukemia etc.) even at very low concentration of VOCs vapors in the atmosphere (Cheng *et al.*, 2022; Li *et al.*, 2023; Wang *et al.*, 2021; Zang *et al.*, 2019). Thus, the effective reduction of VOCs emissions has become an important issue.

To control VOCs emissions, it is preferably to apply one of end-of-pipe recovery technologies, which is more economical and environmentally-friendly due to the mild reaction conditions and valuable VOCs recovery. Hence, several VOCs recovery techniques have been developed, such as adsorption, absorption, condensation or membrane separation technologies (Li *et al.*, 2020b; Li *et al.*, 2023; Zhu *et al.*, 2020). Among these, adsorption technology on porous materials is known to be a widespread and valuable technology due to its excellent features, such as simple operation, low energy consumption, high VOCs removal performance and the ability to recover and reuse both adsorption materials and VOCs (Cheng *et al.*, 2022; Li *et al.*, 2023; Wang *et al.*, 2021). In this technology, the adsorbent is the core of the process. It is well known that activated carbon (AC) has been the most widely applied in VOCs adsorption due to its characteristics like large specific surface area, wide pore size range, surface rich in multiple functional groups, strong selectivity, stable performance, and regenerability (Shafiei *et al.*, 2018; Wang *et al.*, 2021; Zhu *et al.*, 2020). However, it is known that VOCs adsorption on activated carbon always encounters some problems. One of them is fire risk and pore blocking, because the adsorption process is an exothermic reaction, when the adsorption heat released during the

adsorption process may cause overheating and lead to excessive heat accumulation (Huang *et al.*, 2023; Li *et al.*, 2020a). Another frequently encountered problem is hygroscopicity of AC in wet conditions. Water vapor is usually present in VOCs emissions at a high concentration and, in such application scenarios, the co-existent water vapor severely reduces the adsorption performance of AC. Water molecules are preferentially adsorbed on the AC surface and VOCs molecules are adsorbed on adsorbents with pre-adsorbed water to partially replace water molecules. Even though AC presents certain hydrophobicity, the VOCs adsorption capacity decreases, even by 50%, with increasing of water vapor, especially at relative humidity (RH) above 60%. Another issue that arises is related to the amount of water resulting from the regeneration of saturated AC. The more water vapor is adsorbed from the gaseous stream, the more water will be co-desorbed with the VOCs in the regeneration step leading to the production of liquid effluents that require additional treatment (Li *et al.*, 2020b; Li *et al.*, 2023; Shafiei *et al.*, 2018; Wang *et al.*, 2021). Thus, different adsorption materials should be tested for VOCs adsorption to overcome these problems.

n-Hexane (C₆H₁₄) is one of the most important representatives of VOCs, an aliphatic hydrocarbons which mostly results from the use of oil and its products as well as from their transport and storage. Especially, it results from its use as a solvent in various industry worldwide like automotive, pharmaceutical, food and textile industries, leading to environmental degradation and human illnesses. It has neurotoxic potential and can lead to polyneuropathy for human beings because it can form oxidative products metabolized in the body, such as 2,5-hexanedione (Li *et al.*, 2023; Nagarajan and Chandiramouli, 2022). Therefore, C₆H₁₄, is selected as the target compound in this study.

In this context, this paper aims at performance evaluation of *n*-hexane vapors adsorption by two polymeric resins, named MN 202 and MN 250, compared to performance recorded by a granulated activated carbon named AC 20, and, also, to analyze the effect of water vapor from environment on the *n*-hexane vapors adsorption performance, in static conditions.

2. Materials and Methods

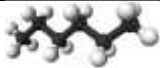
2.1. Materials

Adsorbents: two commercial polymeric resins namely MN 202 and MN 250 were used in this study. Both polymers are non-functionalized with a hyper-reticulated structure, macroporous polystyrene crosslinked with divinyl-benzene, which gives to the solid both macroporosity and microporosity leading to control over pore size and relatively large surfaces areas for polymeric resins. The results recorded by both polymeric resins were compared with those recorded by a commercial bituminous activated carbon, AC 20 - granular activated. The

physical characteristics of all adsorbents used in this study were presented in the previous work (Buburuzan, 2020). Adsorbents were procured from Purolite International Ltd., Country offices of Purolite Corporation in Bucharest, Romania.

VOCs: *n*-hexane, being a typical non-polar and inert alkane, and it is widely used as an industrial solvent, was selected as the VOC surrogate in this study. The physico-chemical characteristics of *n*-hexane are summarized in Table 1.

Table 1
Physical-Chemical Parameters of n-hexane

Structure	Molecular weight, (g/mol)	Molecular diameter (nm)	Molecular length (nm)	Boiling point, (°C)	Heat of vaporization (kJ/mol)
	86.18	0.265	0.681	68.8	31.9
Dipole moment, (x 10 ⁻²⁹ C m)	Saturation vapour pressure at 25°C (atm)	Polarizability (x 10 ⁻²⁴ cm ³)	Ionization potential (eV)	Dielectric constant	Surface tension (mN/m)
0	0.198	11.9	10.13	1.89	17.89

n-Hexane (C₆H₁₄) was purchased from Chemical Company with an analytical grade of 99.9% and used in this study without further purification.

2.2. Static adsorption experiment

To investigate the adsorption performance of both polymeric resins and of GAC-AC 20 for *n*-hexane vapors, the experiments were conducted in static conditions at 298 K. For this purpose, headspace vials with a volume of 20 mL equipped with a septum were used. 0,01 g of each studied adsorbents was introduced into each vials and inside the vials different concentration of *n*-hexane were created, from 0 to 46050 ppm. These concentrations were created by injection of liquid *n*-hexane through the septum using a Hamilton syringe with a 0.1 µL volume. Then, the adsorption equilibrium was expected to be reached while the vials were kept for 24 hours in the dark.

To investigate the influence of relative humidity of the atmosphere on the adsorption efficiency of *n*-hexane vapors, the open vials containing 0.01 g of each adsorbent were kept in a perfectly sealed vessel where a controlled humidity was created, until water vapors equilibrium was achieved. By means of supersaturated solutions of salts that dictate certain humidities in atmosphere were created different relative humidity's ($RH = 33\%$, 75% , 84% and 97%) where the experiments of adsorption were carried out. Then, the vials were tightened and different concentrations of *n*-hexane vapors were created in their headspace by

injecting a different volume of liquid *n*-hexane. After that the vials were kept in the dark to achieve the adsorption equilibrium of *n*-hexane vapors.

The concentration of *n*-hexane vapors in the vials was analyzed on a gas chromatograph equipped with a FID detector. Thus, after reaching the adsorption equilibrium in the vials, with a gas-tight syringe, a volume (3 mL) was taken from the headspace of the vials and introduced into the gas chromatograph. Each test was performed three times in order to obtain an accuracy of the results.

Before each experiments the adsorbents were pretreated in at 120°C for 24 hours and then cooled at room temperature to remove the contaminants and the moisture that were adsorbed by them during storage.

The adsorption efficiency of the adsorbents was evaluated by the *n*-hexane vapours removal, *R*, [%], (Eq. (1)):

$$R (\%) = \frac{C_0 - C}{C_0} \cdot 100 \quad (1)$$

and by adsorption capacity (*q* - amount of *n*-hexane vapors adsorbed per 1 gram adsorbent), [mg/g] (Eq. (2)):

$$q (\text{mg/g}) = \frac{(C_0 - C) \cdot V}{m_{\text{adsorbent}}} \quad (2)$$

where: C_0 and C are *n*-hexane vapours concentration, initial and at equilibrium, [mg/m³] or [ppm]; V is the volume of gas in the headspace vial, [m³]; $m_{\text{adsorbent}}$ is the amount of adsorbent used, [g].

The adsorption capacity of adsorbents for water vapor, % *water adsorbed*, was calculated using (Eq. (3)):

$$\% \text{ water adsorbed} = \frac{m_{\text{adsorbent}}^{\text{water}}}{m_{\text{adsorbent}}} \cdot 100 \quad (3)$$

where: $m_{\text{adsorbent}}^{\text{water}}$ is amount of water gained by adsorbent at equilibrium, [g] and $m_{\text{adsorbent}}$ is the amount of adsorbent used in test, [g].

The adsorbed amount of *n*-hexane vapors, express in %, was calculated using (Eq. (4)):

$$\% \text{ n-hexane adsorbed} = \frac{m_{\text{adsorbent}}^{\text{n-hexane}}}{m_{\text{adsorbent}}} \cdot 100 \quad (4)$$

where: % *n-hexane adsorbed* is the adsorption capacity of adsorbents for *n*-hexane vapors, express in %; $m_{\text{adsorbent}}^{\text{n-hexane}}$ is amount of *n*-hexane vapors adsorbed on the surface of adsorbents at the time t , [g] and $m_{\text{adsorbent}}$ is the amount of adsorbent used in test, [g].

3. Results and Discussion

3.1. The influence of *n*-hexane vapors concentration

The effect of initial *n*-hexane vapors concentration on the performance of adsorption for the polymeric adsorbents MN 202 and MN 250 and for the GAC

AC 20, expressed by the removal efficiency by adsorption (R , %) and by the adsorption capacity (q , mg/g) are presented in Fig. 1. All experiments were carried out using 0.01 g of each adsorbent at different concentrations of *n*-hexane, in the range 0 – 46050 ppm and at room temperature.

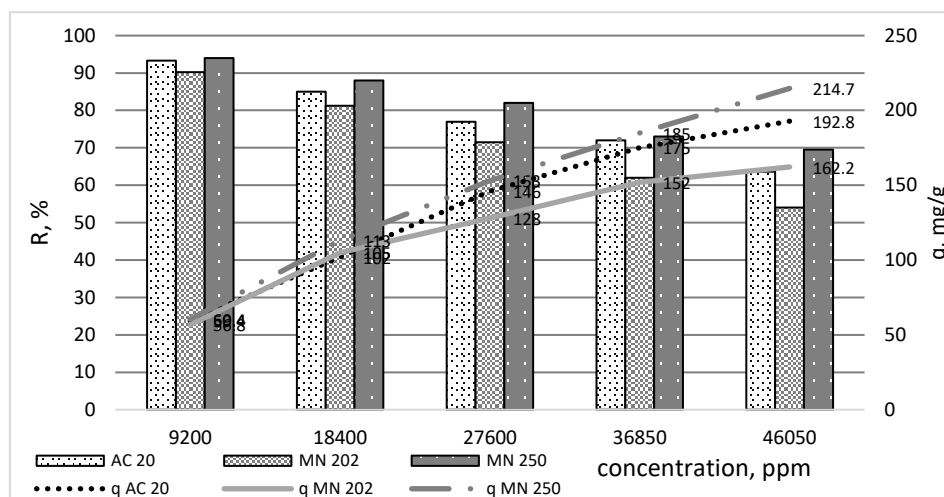


Fig. 1 – The variations of adsorption efficiencies (R , %) and of adsorption capacities (q , mg/g) of adsorbents MN 250, MN 202 and AC 20 depending on the concentration of *n*-hexane vapors.

Obviously, Fig. 1 shows that the adsorption removal efficiency for each adsorbent studied decreases with increasing concentration of *n*-hexane vapours in the headspace vials. The best values for the adsorption removal efficiency of *n*-hexane vapours are obtained at lower VOC concentrations in the vials. For example, at a concentration of 9200 ppm, R records the following values: 94% for MN 250, 93.3% for AC 20 and 90.2% for MN 202, respectively. As the concentrations of *n*-hexane vapor in the vials increase the adsorption removal efficiency decreases both for polymeric adsorbents MN 250 and MN 202 and for activated carbon AC 20. Thus at a concentration of *n*-hexane vapours of 46050 ppm, the values recorded by R are 70% for MN 250, 63.6% for AC 20 and 54% for MN 202, respectively. The most pronounced decrease is recorded by MN 202 polymeric resin which reduces its adsorption removal efficiency by 40%, while the smallest decrease is registered by MN 250 polymeric resin with a 25% decrease in R , and granular activated carbon AC 20 had a 32% decrease in R . From this point of view, it is obvious that the adsorption performance of *n*-hexane vapours is achieved in order MN 250 > AC 20 > MN 202.

Considering the adsorption capacity to *n*-hexane vapors (q , mg/g), it increases with increasing concentration in the vials. Therefore, for an atmosphere concentrated in VOCs, at a concentration of 46050 ppm of *n*-hexane in vials, the

adsorption capacities q , expressed in mg/g, recorded by the polymeric adsorbents and activated carbon were 162.2 for MN 202, 214.7 for MN 250 and 192.8 for AC 20. Thus, considering the adsorption capacities recorded by the studied adsorbents against *n*-hexane vapors, the performance of the adsorption process is achieved in order MN 250 > AC 20 > MN 202.

It can be seen that the hypercrosslinked polymeric resins, both MN 250 and MN 202, show high adsorption efficiencies for *n*-hexane vapors even at high concentrations of VOCs. Furthermore, the performance of MN 250 polymeric resin exceeds that of AC 20 granular activated carbon for the entire concentration range studied.

3.2. The influence of relative humidity on adsorption removal

In the previous work (Buburuzan, 2020), the adsorption capacities of these adsorbents for water vapors at different relative humidities of the atmosphere were presented, where it was shown that the GAC - AC 20 has the highest affinity for water vapors, followed by the MN 250 polymeric resin and then the MN 202 polymeric resin. This aspect represents a major advantage for these polymeric adsorbents toward activated carbon AC 20, which will materialize, first of all, through a very small quantity of co-desorbed water during the regeneration step of saturated adsorbents.

Fig. 2 shows the experimental results recorded for removal efficiency R , [%], of *n*-hexane vapours by the MN 250 and MN 202 polymeric adsorbents and GAC - AC 20 studied under static conditions at 298 K, at different relative humidities RH , [%] in the vials and at different VOC concentration. As expected, the adsorption performance of *n*-hexane vapors quantified by R , [%] is negatively influenced by the atmospheric humidity for all the adsorbents studied. Also, from Fig. 2. (a)-(c) it can be seen that the decrease of R , [%] is more pronounced at high atmospheric humidity, ($RH=97\%$) and at high concentrations of *n*-hexane vapours in the vials. The decrease in adsorption efficiency R , [%] with the increase in relative humidity RH , [%] leads to the progressive decrease in the adsorption capacity of *n*-hexane vapours q [mg/g] for each adsorbent studied. Similar results have been reported in the literature regarding the impact of atmospheric humidity on the adsorption of VOCs vapours by different adsorbents (Buburuzan, 2020; Cheng *et al.*, 2022; Li *et al.*, 2020; Yu *et al.*, 2023).

It is also observed that the decrease of the adsorption removal efficiency of *n*-hexane vapors is more pronounced for activated carbon AC 20 compared to polymeric resins studied. Similar results were recorded for the adsorption of toluene vapors by these adsorbents in similar conditions (Buburuzan, 2020). Thus, in situations of high environmental humidity, the polymeric adsorbents MN 202 and MN 250 behave much better in terms of the VOCs vapors adsorption compared to GAC-AC 20.

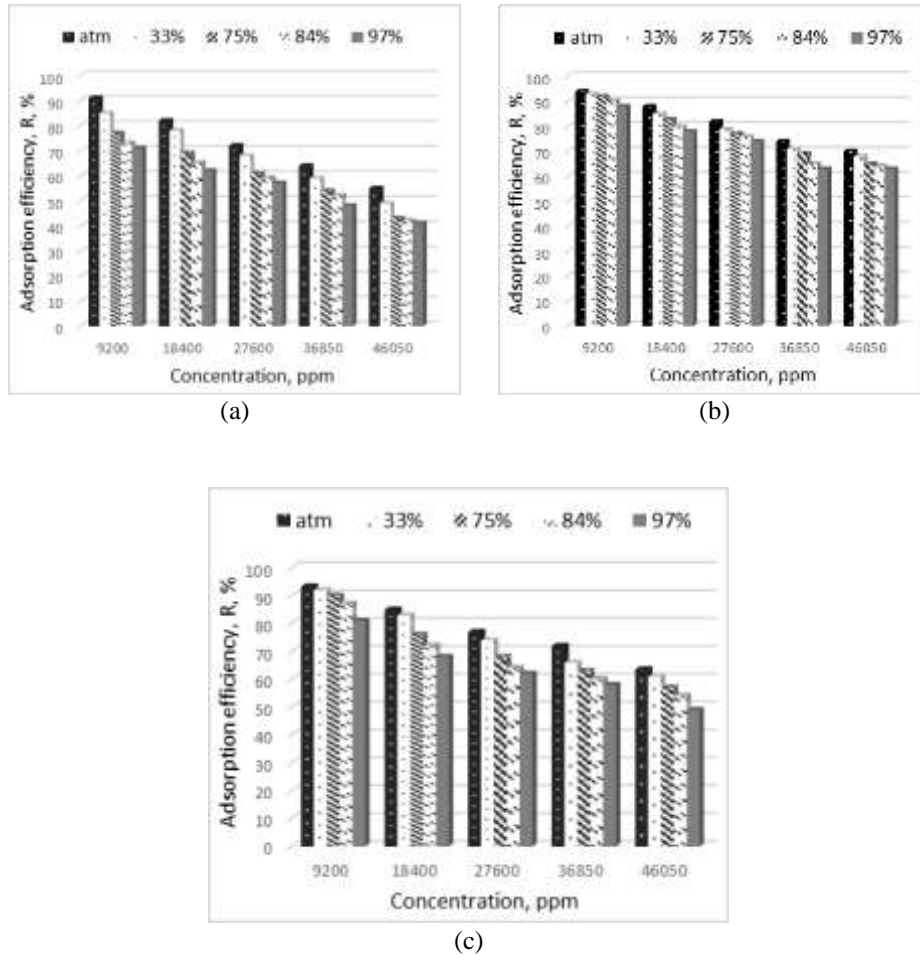


Fig. 2 – The influence of relative humidity (RH , %) on the adsorption removal efficiency of n -hexane vapors (R , %) by adsorbents MN 202-(a), MN 250-(b) and AC 20-(c).

3.3. The influence of the relative humidity on the adsorbent type

Fig. 3 shows the comparative variation of the adsorption removal efficiencies recorded by activated carbon AC 20, and polymeric adsorbents, MN 250 and MN 202, for n -hexane vapors (R , %) as a function of the relative humidity of the atmosphere (RH , %) at different concentration of VOC, in static conditions and the temperature of 298 K.

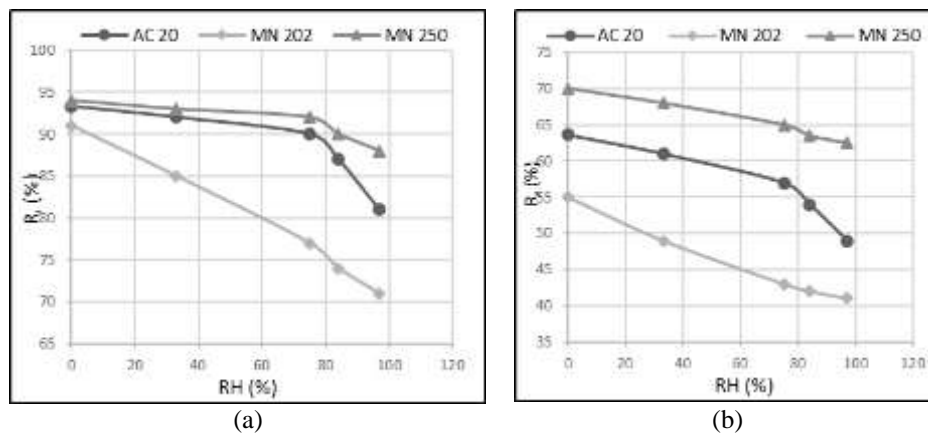


Fig. 3 – Comparative variation of the removal efficiencies for *n*-hexane vapors (R , %) as a function of the atmospheric relative humidity at different concentrations of VOC: (a) – 9200 ppm and (b) – 46050 ppm.

As can be seen from Fig. 3, the removal efficiencies for *n*-hexane vapors is reduced for each of adsorbents with increasing of relative humidity but the most affected is polymeric adsorbent MN 202. Therefore, at a low concentration and a variation of relative humidity up to 97% (Fig. 3a), the adsorbents reduce their removal efficiencies of *n*-hexane vapors as follows: by 6% MN 250, by 13% AC 20 and by 22% MN 202. In an atmosphere concentrated in *n*-hexane vapors and at relative humidity variations up to 97% (Fig. 3b) the decrease in removal efficiencies is achieved as follows: by 10,5% for MN 250, by 23% for AC 20 and by 25.45% for MN 202.

Also, it can be seen from Fig. 3 that both polymeric adsorbents studied showed a decrease in removal efficiency steadily with increasing relative humidity, while granular activated carbon AC 20 showed a sharp decrease in removal efficiency at RH above 75%.

3.4. The competitive adsorption of water and *n*-hexane vapors

In order to investigate the performance of competitive adsorption of water and *n*-hexane vapors onto MN 202, MN 250 and AC 20 adsorbents, the experiments were carried out in two stages: first stage consists in saturating the adsorbents with water vapors. After reaching equilibrium, which occurs after 24 hours, supersaturation conditions with *n*-hexane vapors were created in the vessel and continued with the adsorption of *n*-hexane vapors by the studied adsorbents until equilibrium of *n*-hexane vapors was reached (after 48 hours). Then the adsorption capacities of the adsorbents (q , mg/g) for *n*-hexane vapors, after being saturated with water vapors at the studied humidities, were determined and

compared with their maximum capacities for *n*-hexane vapors recorded under ambient conditions. The results are presented in Fig. 4.

The maximum adsorption capacities (q_{max} , mg/g) recorded in an atmosphere supersaturated with *n*-hexane vapors, at 25°C and atmospheric pressure were 200 for AC 20, 290 for MN 202 and 350 for MN 250 respectively.

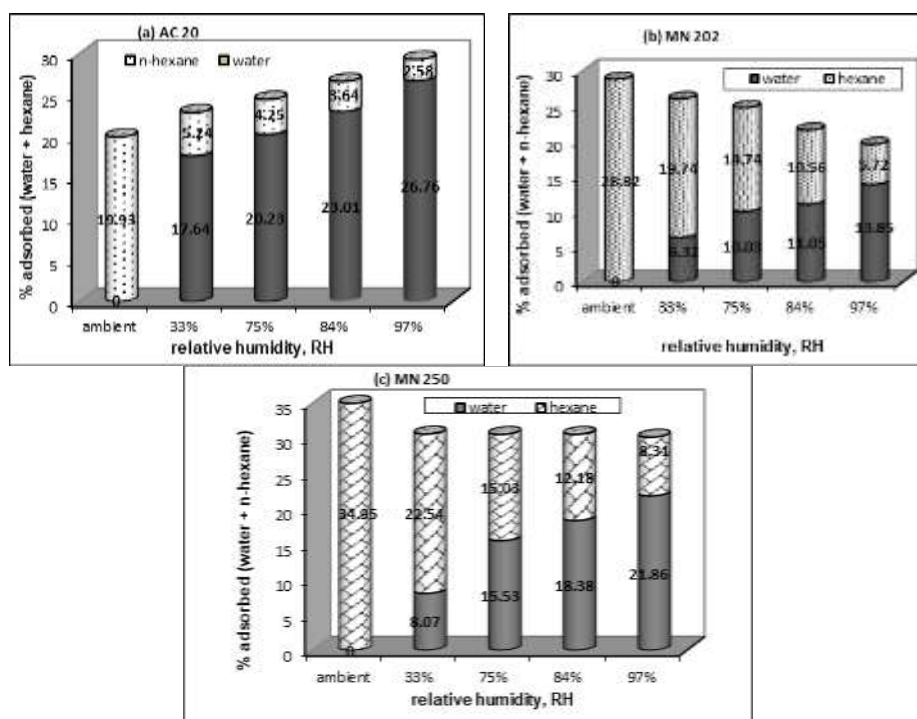


Fig. 4 – Effect of atmospheric humidity on the competitive adsorption of water vapors and *n*-hexane vapors for activated carbon AC 20, and polymeric adsorbents, MN 250 and MN 202, at 25°C and atmospheric pressure.

Fig. 4. shows that AC 20 activated carbon presents a fairly high adsorption capacity for water vapors and its adsorption capacity for *n*-hexane vapors is considerably reduced. It is observed that the adsorption capacity of AC 20 for *n*-hexane vapors at atmospheric humidity was almost 20% and this sharply decreases with increase of RH: this was only 5.24% at RH = 33% and drops to 2.58% at RH = 97%. The polymeric resins, MN 202 and MN 250, adsorb a smaller amount of water vapors compared to AC 20. Thus, MN 202 adsorbent recorded an adsorption capacity for water vapors of 6.32% at RH = 33% and increases to 13.85 for RH = 97%, and MN 250 adsorbent recorded 8.07% and respectively 21.86%. This fact indicates that these adsorbents have rather a hydrophobic character than a hygroscopic one. Consequently, this leads to a

smaller decrease in *n*-hexane adsorption capacity with RH increases compared with AC 20 activated carbon. So, for MN 202 adsorbent, $q_{n\text{-hexane}}$ (%) recorded at RH=33% was 19.74% and decreases until 5.72% at RH=97%, and for MN 250 adsorbent, these values were 22.54% and 8.31% respectively. Therefore, it can be said that in the case of MN 202 and MN 250 polymeric resins the *n*-hexane molecules more easily displace water molecules adsorbed physically on the polymeric resins surface than in case of AC 20 activated carbon and it is more efficiently to use polymeric resins adsorbents for VOCs vapors in humid conditions.

4. Conclusions

This study aims to evaluate the adsorption performance of two polymeric adsorbents with hyper-crosslinked structure and without functional groups, namely MN 250 and MN 202, for *n*-hexane vapors adsorption, especially in humid atmosphere, in static conditions. All tests were carried out in comparison with *n*-hexane vapors adsorption by AC 20 activated carbon, under similar conditions. The obtained results indicate that:

- The adsorption efficiencies quantified by adsorption removal (R , %) of *n*-hexane vapors by all studied adsorbents decreases with increasing of *n*-hexane vapors concentration in system, but still very high (e.g.: at 46050 ppm R is over 60%) and is recorded in order MN 250 > AC 20 > MN 202.

- The adsorption capacities (q , mg/g) increase with raising in *n*-hexane vapors concentration in vials and the MN 250 polymeric adsorbent records values of q even higher than those achieved by GAC-AC 20 for all conditions studied.

- It is observed that, in the humid environment, the adsorption capacity for water vapors of activated carbon AC 20 is much higher than those recorded by the MN 202 and MN 250 polymeric adsorbents, for each of the RH studied which will lead to a large amount of water in the regeneration stage.

- With the increase of the relative humidity in the vials the efficiency of *n*-hexane vapors adsorption (R , %) decreases, but this is less pronounced for the MN 250 and MN 202 polymeric adsorbents that showed a steadily decrease with increasing RH , while GAC - AC 20 showed a sharp decrease in removal efficiency, especially for RH above 75%.

- Likewise, the adsorption capacities (q , %) recorded by both tested polymeric resins for *n*-hexane vapors, achieved under supersaturated conditions with water vapors, are less affected by the RH in the environment and, in this case, the *n*-hexane molecules more easily displace physically adsorbed water molecules on the surface of polymeric resins.

In conclusion, the obtained results show that both tested polymeric hyper-crosslinked resins, MN 250 and MN 202, are a good option for *n*-hexane vapors removal, especially in high humidity environment. These polymeric resins adsorb less water than GAC - AC 20 due to their hydrophobic rather than hygroscopic

character. Consequently, the adsorption capacities of MN 202 and MN 250 for *n*-hexane vapors are less disrupted by the presence of water vapors in the gaseous stream, and the competition between VOCs molecules and water is not as strong as in the case of activated carbon AC 20.

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EFFECTELE UMIDITĂȚII RELATIVE A ATMOSFEREI ASUPRA
PERFORMANȚEI PROCESULUI DE
ADSORBȚIE A VAPORILOR DE *n*-HEXAN ÎN CONDIȚII STATICE

(Rezumat)

Lucrarea de față își propune să analizeze performanțele de adsorbție a doi adsorbantți polimerici hiperreticulați, nefuncționalizați, MN 202 și MN 250, față de vaporii de *n*-hexan, într-un sistem static. Pentru validarea rezultatelor, toate experimentele de adsorbție s-au desfășurat în aceleași condiții experimentale utilizând ca adsorbant un cărbune activ granular, CAG-AC 20. Deoarece prezența apei în fluxurile gazoase reprezintă unul dintre parametrii cruciali care dictează eficiența procesului de adsorbție a vaporilor de COV, s-a urmărit și influența umidității relative, la diferite concentrații de *n*-hexan în sistem, asupra performanței procesului de adsorbție înregistrate de adsorbantții MN 250, MN 202 și AC 20. Datele obținute evidențiază faptul că adsorbantții polimerici, MN 202 și MN 250, înregistrează performanțe de adsorbție a vaporilor de *n*-hexan, cuantificate prin eficiența de îndepărtare a vaporilor de COV (R , %) și capacitatea de adsorbție (q , mg/g) mai ridicate decât în cazul cărbunelui activ AC 20. Astfel, eficiența de îndepărtare a vaporilor de *n*-hexan, pentru întreg domeniul de concentrații studiat, se realizează în ordinea MN 250 > AC 20 > MN 202. În plus, într-o atmosferă cu umiditate ridicată ($RH > 70\%$), adsorbantții polimerici, MN 202 și MN 250 funcționează mai bine decât cărbunele activ AC 20, realizând eficiențe de îndepărtare a vaporilor de *n*-hexan mai ridicate. Rezultatele acestui studiu arată faptul că adsorbantții polimerici hiper-reticulați MN 250 și MN 202 reprezintă o alegere bună pentru reținerea vaporilor de *n*-hexan, în special într-un mediu cu umiditate ridicată. Acești adsorbantți, MN 202 și MN 250, au mai degrabă un caracter hidrofob decât higroscop și astfel adsorb mai puțini vapori de apă. În consecință, capacitățile de adsorbție ale acestor rășini polimerice sunt mai puțin afectate de RH din fluxul gazos, iar efectul competitiv dintre moleculele de *n*-hexan și apă este mai puțin intens comparativ cu GAC – AC 20.