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Adsorption-Desorption Performance of Different Solid Desiccant Materials

Ravi Pratap [1]
Department of Mechanical Engineering
Madan Mohan Malaviya University of Technology
Gorakhpur, India

Amarjeet Kumar Prashad [2]
Department of Mechanical Engineering
Madan Mohan Malaviya University of Technology
Gorakhpur, India

***Abstract*— Evaluate the performance of different desiccant materials was measured in terms of quantity of water vapour adsorption. To find a suitable desiccant material for the different moist air or relative humidity condition. Here we take different kinds desiccant material on the bases of pore size and pore volumes generally three type of silica gels we take, silica gel A, silica gel B and silica gel C. And for zeolite on the basis of various molar rations of Si/Al (5.6, 29, 47). Activated carbon with different pore size distribution and silica gel level are activated carbon A, activated carbon B used, added to enhance the hydrophobic surface.**

***Keywords*—Desiccant Material, Silica Gel, Zeolite, Activated Carbon.**

I. INTRODUCTION

The desiccant material or dehumidifier which are used for the decrease the relative humidity of moist air and become the moist air into the dry and after the absorption of moisture in the desiccant material, the desiccant material become saturated and this situation can be removed by the hot air on the desiccant material. Nowadays in air conditioning system the desiccant material are used for the saving of energy. It is investigated that the performance of the desiccant material it means the absorption capacity of the desiccant material is different with the different relative humidity some desiccant material have a good absorption capacity at Higher relative humidity and some desiccant material have lower absorption capacity at Higher relative humidity and its performance of desiccant material is depends on the pore size of desiccant material

In this paper we comparative study of different desiccant material such as Silica gel, zeolite and activated carbon with different pore size and pore volume and compare the difference in performance with relative humidity

Some study on Silica Gel, activated carbon and zeolite to evaluating the performance of the desiccant material and how to improve the dehumidification or absorption process of the material it's seen that the Silica Gel is superior to in the debsorption option is possible at relatively low temperature through the moisture can be reduced to lower Dew Point the absorption and absorption phenomena is depend upon the type of Silica Gel zeolite and activated carbon used.

II. MATERIAL DETAILS

1. Silica gels

In this paper we take three type of silica gel namely Silica gel(a), Silica gel(b) and Silica gel(c) on the basis of different pore volume and pore size. And examine that which one is better silica gel for different relative humidity.

2. Zeolites

Here we take three different type of zeolite namely on the basis of ratios of silica and aluminum (Si/Al).

Zeolite	Ratio of silica and aluminum
Si/Al (a)	5.6
Si/Al (b)	29
Si/Al (c)	47

Generally it is seen that at lower temperature, regeneration of zeolite is difficult due bond of water molecules with cation site based on Al in zeolite is partial strong.

3. Activated carbons

Due to hydrophobic surface amount of moisture adsorption capacity affected with relative humidity. Silica gel added in activated carbon change and improve moisture adsorption capacity to change hydrophobic surface. Here we take two type of activated carbon with different silica gel level namely activated carbon A, and activated carbon B.

III. ANALYSIS

1. Silica gel A

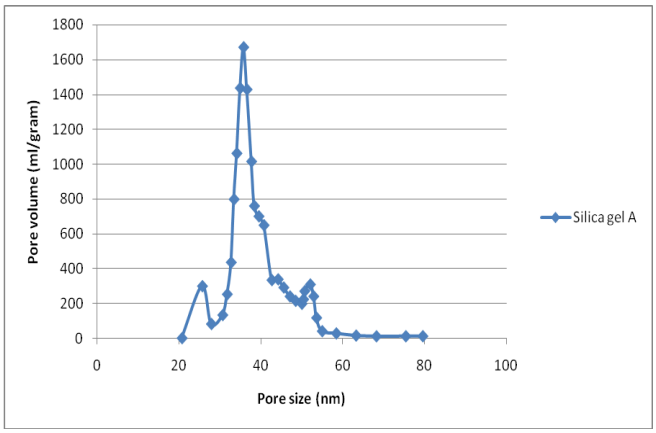

Figure (1)

Figure (1) shows the distribution of silica gelA pore volume with different pore size, as the pore size increases capacity decreases and after 55nm pore size pore volume were uniform and equal to zere value. Peak value of capacity is 1605 mm3/gram at the 38nm pore size

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2. Silica gel B

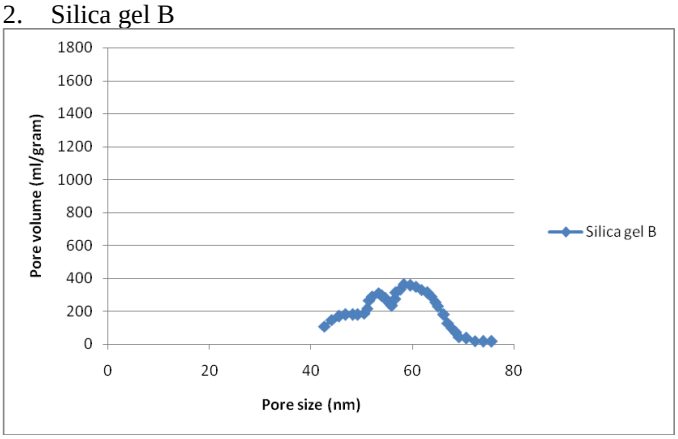

Figure (2)

Figure (2) shows the distribution of silica gel B pore volume with different pore size as shown in graph it is major difference with the silica gelA, it gives maximum pore volume of 385 mm3/gram at 58nm.

3. Silica gel C

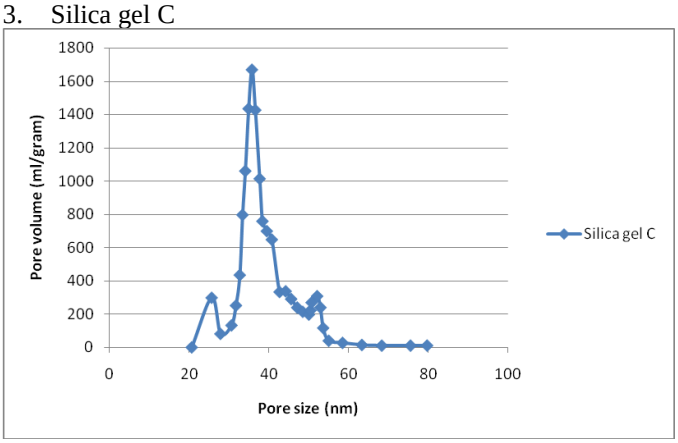

Figure (3)

Figure (3) shows the distribution of silica gelC pore volume with different pore size as shown in graph it is similar to the silica gelA, its peak value is some shifted to the peak value of silica gelA.

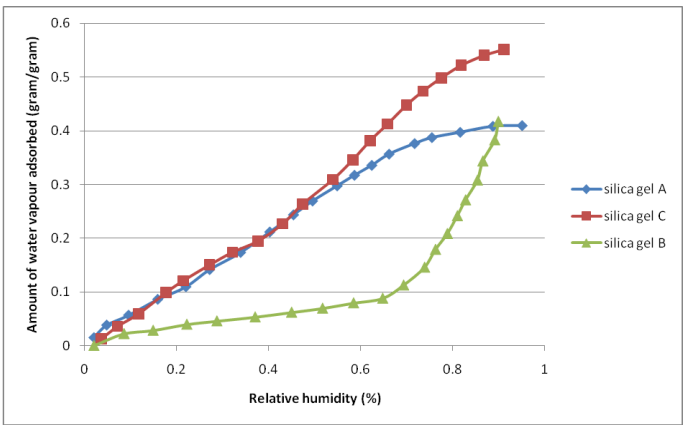

Figure (4)

Figure (4) show the amount of water vapour adsorption with different relative humidity, silica gelC have maximum water adsorption capacity at higher relative humidity compare to the other silica gel whereas the almost same value at the lower relative humidity. Adsorption capacity is abruptly increases at when relative humidity is more then 70%. In case of silica gelA and silica gelC behavior is same till 58% relative humidity. From the figure most effective condition for all three desiccant material is based on water adsorption capacity is

Water adsorption capacity (gram/gram)	Silica gel material
0.27	Silica gel A
0.06	Silica gel B
0.31	Silica gel C

4. Zeolites

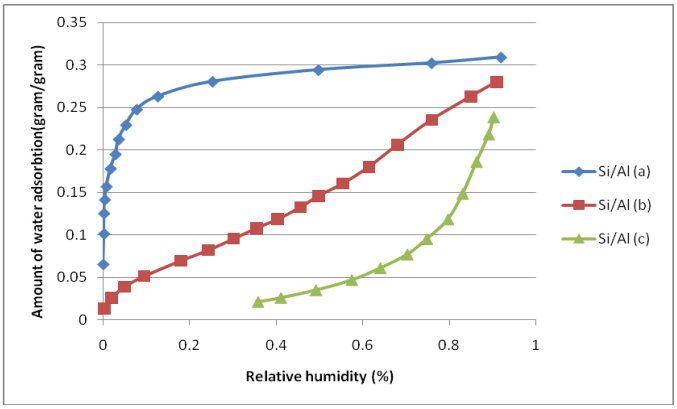

Figure (5)

In this graph the variation of various ratios of silica gel and aluminum (Si/Al) with relative humidity by the figure it is clear that the different ratios of Si/Al strongly affected its amount of water vapour adsorption capacity with different relative humidity. Z(c) is the higher Si/Al ratio element compare to Z(a) and Z(b). It indicated that as the Al value decreases water vapoue adsorption capacity higher at higher relative humidity value and take sigmoid type shape. And if Al content increases water vapour adsorption capacity higher at lower relative humidity value and take Langmuir type shape. The appropriate adsorption amount were 0.05g/g for Z(a), 0.13g/g for Z(b), 0.05g/g for Z(c)

5. Activated carbons

In figure (5) variation of AC(a) and AC(b)is similar to the each other for different pore volume with pore size therefore microstructure was not changed with different hydrophobic type

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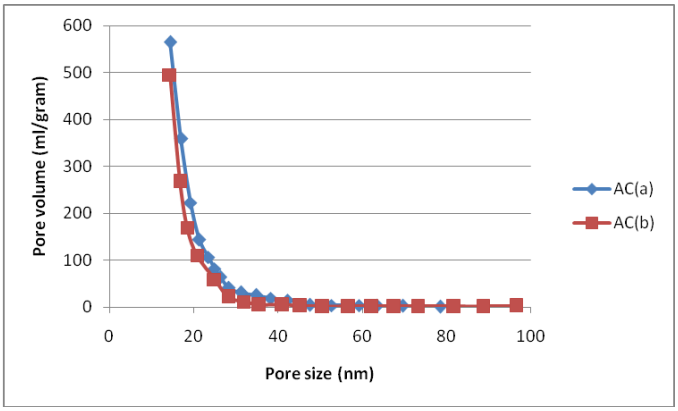

Figure (5)

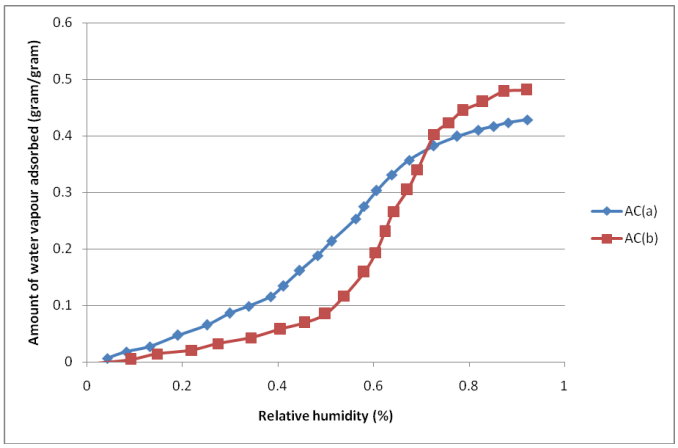

Figure (6)

In figure (6) activated carbon (B) is better as compare to the activated carbon (A) in the intermediate region this is due to activated carbon to obtain a hydrophilic surface. Therefore using of silica gel in pores of activated carbon effectively improved the adsorption of element. And better adsorption amount is 0.25g/g

IV. CONCLUSION

In this paper examine the performance of various desiccant materials on the basis of water vapour adsorption. In the case of silica gel A, B and C effective material for adsorption is 0.27 gram/gram in case of silica gel A, 0.06 gram/gram for silica gel B, and 0.31 gram/gram for silica gel C. In case of zeolite on basis of ratio of silica gel and aluminum 29 gives the maximum water adsorption compare to the other ratios and for activated carbon using with silica gel 0.25 gram/gram give the effective water adsorption.

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