CHARACTERIZATION OF ABSORPTION BEHAVIOR OF SUNFLOWER STEM

Mrs.R.Sukanyadevi[1], M.Nithya[2], R.Vijaya prabhu[3], M.Dhamugiridharan[4]

[1] *Assistant. Professor, Department of Textile Technology, Kumaraguru college of Technology, Tamilnadu, India*

[2] *Final year student, Department of Textile Technology, Kumaraguru college of Technology, Tamilnadu, India*

[3] *Final year student, Department of Textile Technology, Kumaraguru college of Technology, Tamilnadu, India*

[4] *Final year student, Department of Textile Technology, Kumaraguru college of Technology, Tamilnadu, India*

ABSTRACT

The aim of this study is to investigate the absorbency properties of inner core of sunflower stem. Sunflower stem consists of two parts: the pith and the bark. The pith is the inner core of sunflower stem; whereas the bark is the outer layer of the sunflower stem. The pith is segregated from the bark and is ground. The suitable size of the ground particles of sunflower stems is taken to investigate the absorbency properties of sunflower stem. This paper reports study on the development and characterization of absorbent pad made from four different fibrous compositions, namely 1)100%wood pulp, 2)80%wood pulp and 20%sunflower fluff , 3)70%wood pulp and 30%sunflower fluff , 4)100%sunflower core. Hygroscopic properties of specimens depended on their location along the stem. In order to explain these characteristics, morphological observations has been done on the specimen of each location. It was found that both the bark and the pith are denser at the higher locations, and the ratio of rigid tissues in the bark is greater at the higher locations. Sieving process is done to find the particle size of the sunflower fluff(grinded part),so that the suitable size of sunflower fluff can be selected for making the absorbent pad . Free swell absorption test is carried out for all the four different sample and the results were disclosed in this papers. The SEM(Scanning Electron Microscope)view of the sunflower grinded part is also found in this paper. This study highlights the structure , size and absorbency properties of sunflower pith.

Keyword : *Sunflower pith, absorbency properties, specimen, core, morphological.*

1. INTRODUCTION

Sunflower is an annual herbaceous plant belonging to the daisy family, the largest and one of the most popular plants from this family. It can grow up to 4 meters in height. The root is hairy and made of fiber, and it creates a large amount of spacious roots that can penetrate up to 3 meters in the ground. Compared with synthetic fibers, natural fibers offer some advantages including low density, cheapness and biodegradability. Besides industrial crop

activity solely devoted to fiber production, another potential source of natural fiber supply is agricultural by-products.

The aim of this study is to characterize the absorbency properties of an agricultural by-product: for some of the end applications. This paper mainly focuses on the determination of absorbency properties of sunflower stem and its influence on specimen location along the stem. After cultivating the flowers (for sunflower oil), the dried stems were thrown as waste. Instead of throwing that stems as waste, it is tested for their absorbency property. The absorbency property of sunflower stem is found by mixing the sunflower fluff (grinded stem) along with the wood pulp in the absorbent pad. Only those fluffs, having size of above 400 microns are used to manufacture the absorbent pad. This is done with the help of sieving process The test results obtained are presented in this paper.

2. MATERIALS AND METHODS

2.1 MATERIALS

The bark of the sunflower stem is removed to obtain the pith specimens. The sunflower stem is obtained after the cultivation of sunflower for sunflower seed oil

2. 2 METHODS

The bark of the sunflower stem is removed to obtain the pith specimens. The cross sections of the pith specimens were cylindrical in shape and the diameter ranges from 15mm to 25mm, which varies depending on the stems and on the level where they were cut. It was found that the diameter of stem at the middle portion was greater than the diameter at the bottom portion of the stem. On average, the diameter of the pith specimens obtained at the middle of the stem was 1.20 times the value of that obtained at the bottom, and 1.02 times the value of that at the top[1].

Initially the sunflower stem is collected and the pith part of the stem is separated from the stem by removing the bark portion. Now both the pith and bark is grinded manually and mixed together. After this the sieving test is carried out in order to study about the sizes of the grinded particles.

2. 2. 1 SEM ANALYSIS

The SEM analysis of the sunflower pith were observed in two perpendicular directions. The observation showed an alveolar structure. This structure explains the very low density of the pith[2]. It is also mentioned that the sunflower pith retains more than 9 times of its initial weight[2]

2. 2. 2 SIEVE TEST

Sieving test , 2 grams of the test sample is taken from the grinded part with the help of weighing balance. Before starting the test, clean the sieve properly ensuring that no dust particles were stuck between the holes in the sieve. Then the weighed amount of the test sample is placed over the sieve of required size(which is measured in microns)(figure 1(a)). The sieve test procedure is explained as follows,

Initially 2 grams of sample is taken from the grinded part and placed in 425 microns sieve plate. Then the sieve plate is placed in the mechanical vibrator and allowed to vibrate for half an hour. The particles that settled down in the sieve plate is above 425 microns and the particles at the sieve pan is below 425 microns. Then the particles above 425 microns undergo the same procedure with lowered microns. Finally the percentage of sieve with different micron level is calculated.

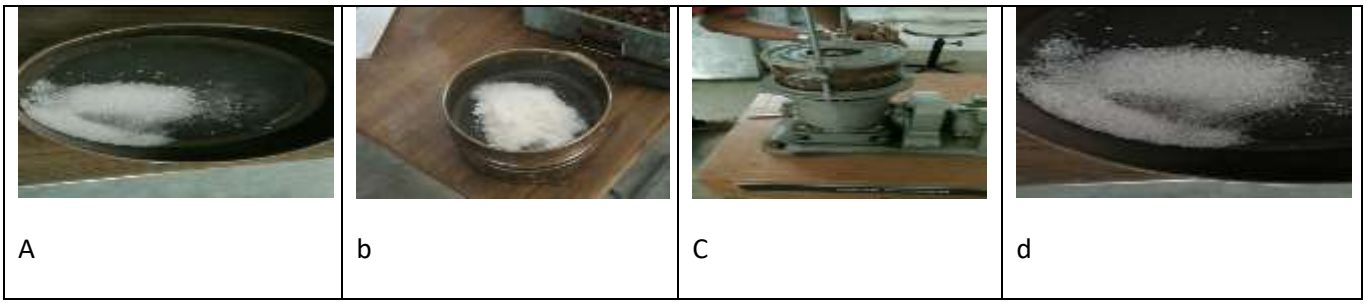

Fig -1: sieving test: a) sieve b)sieve fixed with pan at bottom c)fixing the sieve along with pan in the mechanical vibrator d)fluff particles which are above the size of the sieve.

2. 2. 3 ABSORBENT PAD MANUFACTURING

The absorbent pad is manufactured with 4 different proportions: 1)100%wood pulp(SAMPLE A),2)80%wood pulp and 20%sunflower fluff(SAMPLE B) , 3)70%wood pulp and 30%sunflower fluff(SAMPLE C) , 4)100%sunflower core(SAMPLE D) and it is tested for the absorbency property. The absorbent pad manufacturing process is shown in figure 2. Free swell absorption capacity is found in SITRA and its results are mentioned below(table 2).

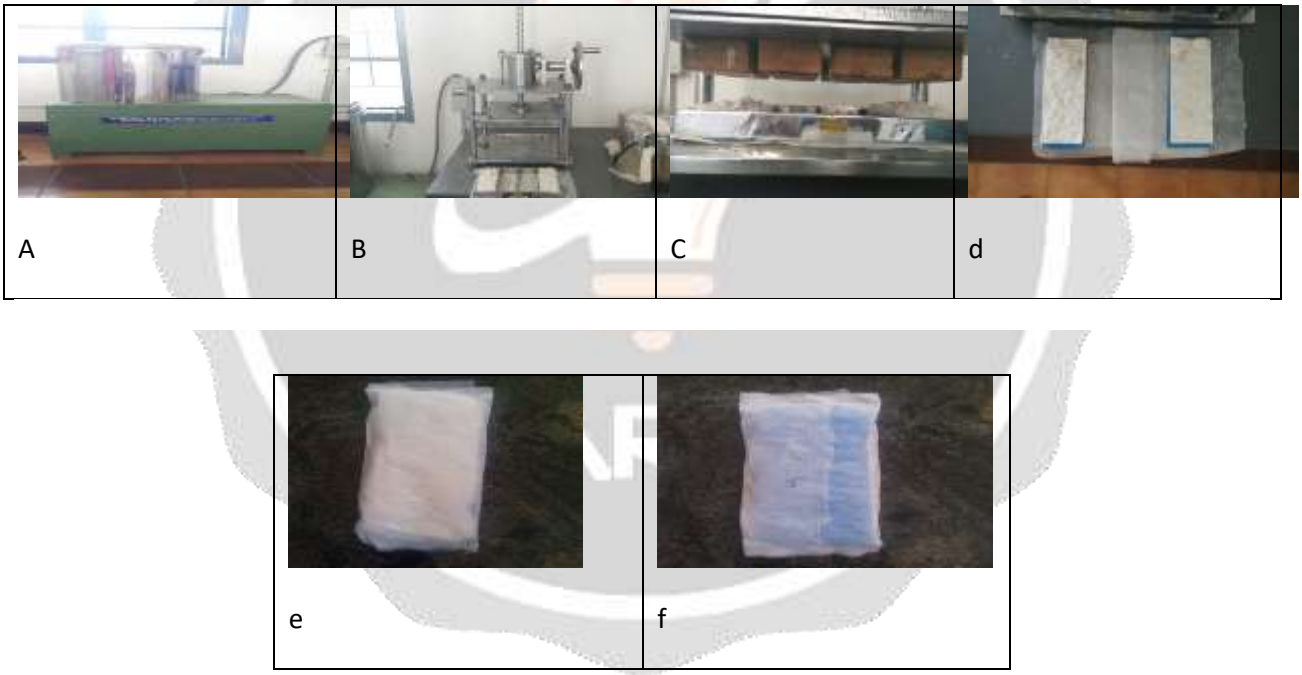

Fig -2: Absorbent pad manufacturing: a) grinding machine to mix the necessary proportion b) absorbent pad manufacturing machine with die c) pressing the wood pulp and sunflower fluff by applying pressure over the die d) after removed from the die e) after fusing – front portion of absorbent pad f) after fusing back portion of absorbent pad.

2. 2. 4 Free swell absorption test

Free swell absorption test is carried out to find the absorption capacity of the napkin. Initially 0.2 grams of sample is taken in polypropylene nonwoven bas. The simulated urine is prepared by adding 9 grams per liter of NaCl in distilled water. The polypropylene bag along with the sample is immersed in the saline solution for half an hour.

After half an hour, the polypropylene bag is drained for 10 minutes and weighed again. Using the initial and final weight of the polypropylene bag, the Free swell absorption capacity of the napkin is found.

3. RESULTS AND DISCUSSIONS

The sieve test, the SEM(Scanning Electron Microscope) test and Free swell absorption test results were discussed as follows.

3.1 SEM analysis

SEM analysis is taken to study the morphological structure of sunflower pith. From this result, it is understood that sunflower pith has many pores. So the liquid can able to accommodate in those pores.

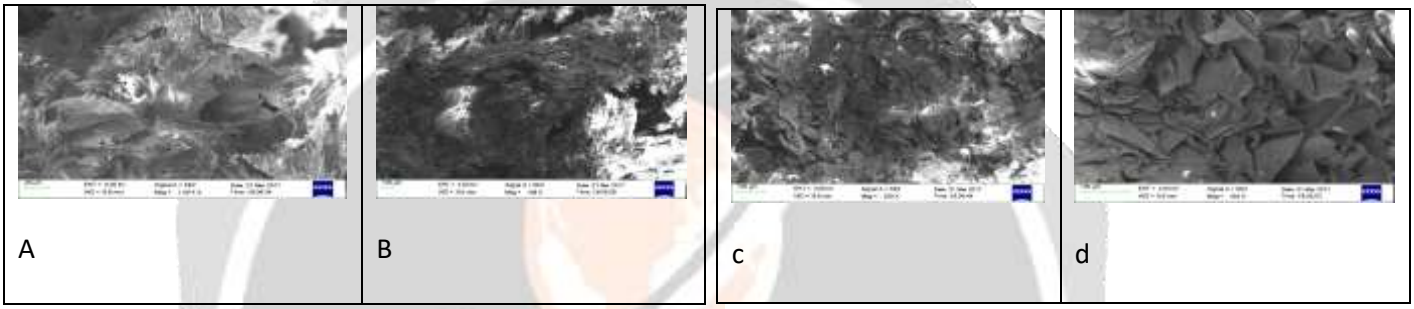

Fig -3: SEM test results

3. 2 Sieve test

The sieve test was done to find the particle size (above 400 microns), which will be suitable for manufacturing absorbent pad. The test results were given as follows, [Total amount of fibers taken (both inner and outer core together) : 2 grams.]

Table -1: Sieve test result

SIZE (MICRONS)	WEIGHT IN GRAMS	%
Below 400 microns	0.81	40.5
400-600 microns	0.22	11
Above 600 microns	0.92	46
Invisible loss	0.05	2.5

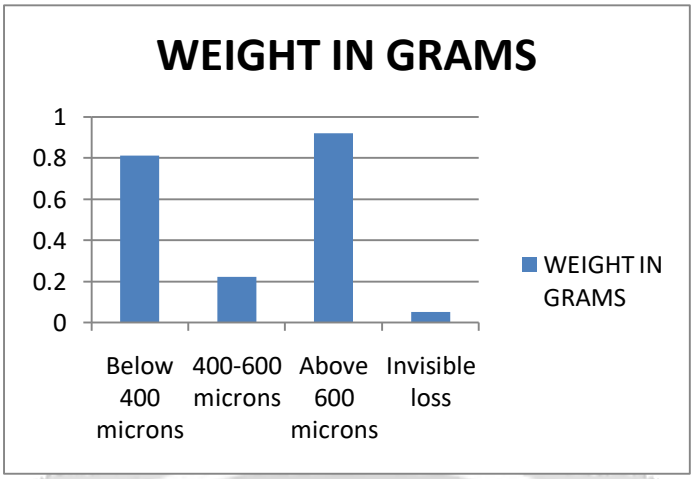

Chart -1: Sieve size vs. weight in grams

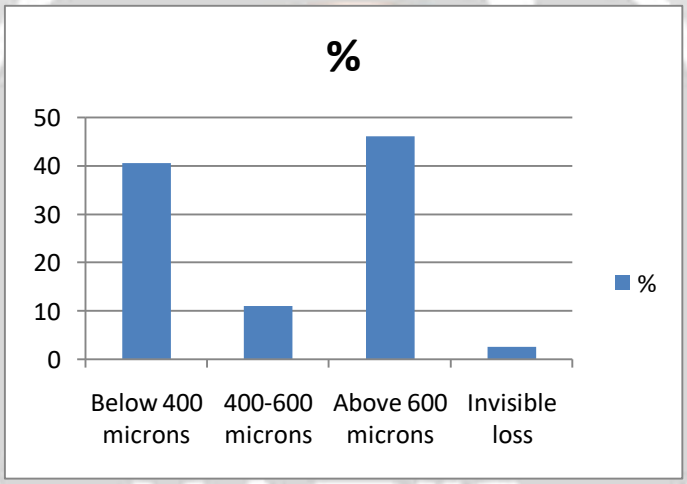

Chart -2: Sieve size vs. percentage of fibers(i.e., in 2 grams)

3. 3 Free swell absorption test

Free swell absorption test is taken to study the absorption characteristics of sunflower pith.

Table -2: Free swell absorption test result

	SAMPLE A	SAMPLE B	SAMPLE C	SAMPLE D
Free Swell Absorption Capacity(gms/gms)	31.91	32.10	32.07	51.50

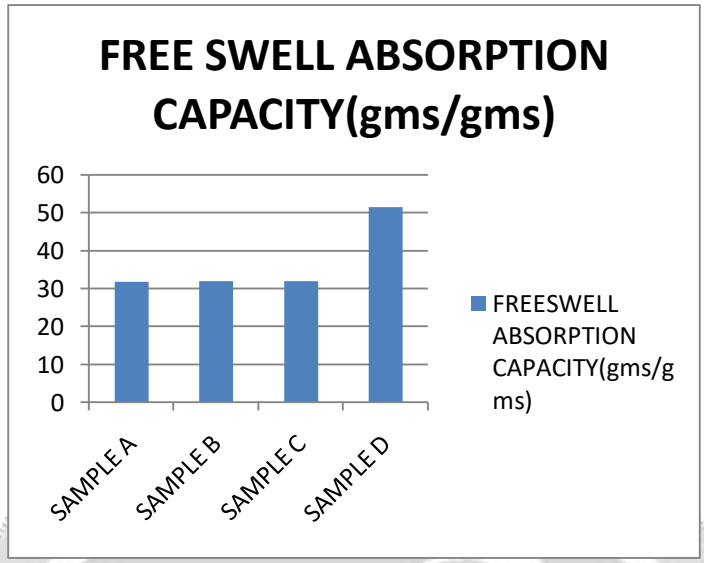

Chart -3: Sample vs. Free Swell Absorption Capacity.

4. CONCLUSIONS

The optimum Sunflower Core particle size range that gives maximum water absorbency is at above 400 microns. Sunflower Core absorbs water due to capillaries and micro-pores but capillary absorption is significantly higher and plays a major role.(which can be seen in figure 3).Refining of Core particles causes a slight reduction in absorption due to fibrillation. Napkin with a blend of 70/30 (Core / wood pulp) , 80/20 (Core / wood pulp) , 100/0 (Core / wood pulp) , 0/100 (Core / wood pulp) can be made and compared for its absorbency property. It is found that, the absorption capacity if the sunflower core gets reduced by blending with wood pulp. It is also seen that, there is no major change in absorption between the different blends so it is concluded that using sunflower stem as absorption core in napkin will reduce the consumption of wood pulp.

5. ACKNOWLEDGEMENT

The authors are thankful to the Physical testing department and biotechnology department, South India Textile Research Association Coimbatore and to the Department of Textile Technology, Kumaraguru College of Technology, Coimbatore.

6. REFERENCES

[1].“Hygromechanical characterization of sunflower stems” by S. Sun, J. D. Mathias, E. Toussaint, M. Grediac. Paper published in Industrial Crops and Products, Vol 46, pp 50-59, 2013.
[2]. “Use of plant aggregates in building ecomaterials” by Camille Magniont , Gilles Escadeillas , Marie Coutand & Claire Oms-Multon . published in European Journal of Environmental and Civil Engineering , ISSN: 1964-8189 (Print) 2116-7214 (Online).