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LOW COST FLOOR-CONCRETES FROM POLYMERCEMENT BLENDS

by

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Since 1953, when he left the laboratory of Prof. Betti and his team, polypropylene has gone a long way in the world's face. This comparatively new material is today widely distributed in the textile field and in the carpet industry. He will here deal with the latter, and in particular with the sector of the textile industry: carpet production.

Its application to the carpet industry is by polypropylene fibre: in the U.S. for example, total production in 1967 was equivalent to about 11,000 tons of wool and about 10,000 tons of cotton. This means that some 70 million square meters of floor coverings made with polypropylene fibre were produced in 1967, and it also means that polypropylene fibres represented more than 10% of the total carpet production in the U.S. and Europe. In other words, one carpet out of seven was made with polypropylene fibre.

After only six or seven years of presence on the market, this is a really good result for polypropylene fibre, which is used in the form of smooth and textured continuous filament, and is transformed in woven rugs, tufted and needlepunched carpets. He should like to emphasize the fact that the carpet sector of the textile industry has never been an easy one to be conquered. Once there was wool, and later by and by than wool; then came man-made fibres and practically each one gained the top position by enlarging its market and allowing the production of more and more beautiful, and more durable carpets.

Today this market is dominated by polyamide fibres, with acrylies following, second and polypropylene and wool following closely. Polyesters are beginning to show up without calling attention to themselves being present.

This brief description of the carpet industry has the purpose of illustrating the world competition of new fibres and to show that polypropylene is to assert its position in this field. Polypropylene has done it, and the figures show its remarkable success.

Having thus made the general picture of polypropylene fibre in the carpet industry clear, we will now restrict our attention to a particular sector of this industry, which is of increasing interest to us: the needle punched floor covering.

This type of floor covering is well known since 25 or even 30 years, but it is today enjoying a sort of second youth, whose blooming can be ascribed

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SUMMARY

LOW COST FLOOR-COVERINGS
FROM POLYPROPYLENE FIBRES ^{1/}

by

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Polypropylene has won today a worldwide acceptance in the field of plastics and packaging, as well as in the textile industry. Use of polypropylene fibre in the production of floor-coverings is illustrated. Consumption data show the size of this market for different countries, and also the significant penetration achieved by this comparatively new fibre in such a competitive sector.

In particular, needle-punched carpets are reviewed, both from a manufacturing stand point and with regard to the properties of fabricated articles. The economics of this process for carpet production are briefly illustrated. Future developments are anticipated.

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The properties of fiber blend polypropylene fibers are then discussed
giving special reference to those characteristics that are particularly mean-
ingful for their influence on the final product:

lightness

acid and alkali resistance

chemical resistance

dimensional stability

dyability

Some actual applications of fiberblend R in this field are illustrated in
detail (samples will be available at the Symposium).

exclusively to the properties of polypropylene and polyamide fibres, as we will see later. The carpet production is divided into different stages which will be briefly revised hereafter.

The blending stage consists of the staple fibre, and consists in blending fibres with different characteristics in colour, chemical nature, fineness or other characteristics. It is a common practice to do so both for economic and technical reasons:

- blending of different coloured fibres is often necessary to improve both aesthetical and mechanical resistance of the carpet surface
- sometimes a more expensive fibre is "diluted" with a cheaper staple to bring down the cost to a predetermined level
- by using fibres of different denier special effects can be obtained on the carpet surface.

Blending is usually done on normal wolf-cards.

After blending the fibres go through the web-forming machines, usually high production machines but not identical to those used in wool spinning. The fibre mass is thus transformed in a card web that in turn is made into a number of layers, so to reach a certain weight per unit surface.

This same operation can be done by other machines that form the fibre web through use of artificial air flow, thereby eliminating the card. Such machines are built by Heilmann, Kohlhoeffel, or Ingleiter.

The web, whether formed by the card-lapper unit or by these machines, is then coupled with a second fabric whose purpose is to increase the mechanical resistance of the final article. Sometimes this is not necessary and therefore the web goes directly to the needle-punching loom.

This machine is usually what makes the hob, in the sense that it changes a loose fibre mat into something that could already be defined as a floor covering. This needle-punching loom is essentially made up with:

- a support table on which the fibre web is passed
- a wooden or metal bar from which hundreds of barbed needles are sticking out towards the fibre web; this bar has a reciprocating motion off/towards the support table and in doing so it pierces the fibre web

... for the needle-punched web or a feeding system for the following
... .

The hardest needles for the needle-punching are that they bring fibres
... only with a slight compression, and the fibre web is thoroughly
... after passing through the needle-punching loom.

After this essential work the following follows. It is done either by
... the carpet with a special material and curing it, or by coating
... of the carpet with a special material. The carpet
... finished and ready for sale, but a very important operation can be
... to the process: tile cutting.

Automatic machines cut off from the carpet roll square tiles 25 x 25 cm
... 40 x 40 cm that are sold in boxes, each containing twelve or twenty tiles.
... cases, before tile cutting the carpet is back-coated with an adhesive
... that the tiles can be glued to the floor by the end-user himself. If we
... examine the process we have just finished describing, one simple but
... consideration comes to our mind. In one single process, that can
... out with no interruption, the carpet fibre is transformed into a
... covering. And this is why we call these carpets "low cost floor
...".

We think it is useful to give a rough and approximate idea of the
... costs required for such a plant. Our data referred to machines
... by firms of world-known importance, specially studied for this kind
... production, in a width of 3 mt.

	Millions Rrs.	Millions Rrs.
a. blending		6.0
b. web forming		
- 2 pickers	20.0	
- 2 cards	30.0	
- 2 mappers	10.0	60.0
c. needlepadding		
- 3 needle-loom	36.0	
- edge cutters and accessories	3.5	9.5
d. finishing (boiler not included)		55.0
e. tile cutting		<u>9.0</u>
Total investment		<u>160.5</u>

Such a plant has a capacity of abt. 1,500 sqm of finished product for an eight hours shift and requires 5 men/shift plus stocking and warehousing.

We have seen that the production of needle pile carpet is a simple and economic process. Let us go a step further and say why such a carpet should be made (and in most cases is made) with polypropylene staple fibre.

The characteristics of major importance for a fibre to be transformed into a carpet - those which in a certain sense form the basis for the attainment of commercial success - are:

1. resistance to wear and tear
2. resistance to soil and to staining
3. colour fastness

Such characteristics are in fact necessary for the long life of the carpet expected and demanded by its purchaser.

Secondly, appraisalment could be made of other characteristics, which to our mind are of a certain importance, namely:

... ..

... ..

... ..

... ..

Resistance to wear

... ..

... ..

Impact resistance

Compression resistance

... ..

... ..

Figure 2 gives the results obtained for a fibre of fib as in an abrasion test made by passing a filament through a standard abrasive file, attaching a weight to the filament and allowing the weight to rotate; the loads in grams/centimeter are given in the table, and the number of revolutions required to break the filament are shown in the column.

Polypropylene and polyamide fibres are able to withstand relatively high loads encountered in the use of carpeting, synthetic fibre and wool yield completely.

And since resistance to dirt is an important property in double punched floor coverings, we found that polypropylene and polyamide fibres are indeed superior to wool.

2. Soil and stain resistance

One of the reasons why carpeting is not used extensively into certain markets lies in the common opinion that it is difficult to clean, that they stain easily and lose their appearance if they are not carefully looked after.

Much of this sort of thinking has been dispelled from the public mind by the ever-increasing use of synthetic fibres, which offer high resistance to dirt, mildew and abrasion, every novelty in this field, every step ahead in the use of the "new" carpet, is eagerly welcomed by a large number of consumers who are worried about the bother carpet maintenance requires.

From this particular point of view, the synthetic fibres guarantee of security and absolute assurance of their resistance to the properties that its chemical nature endows upon it.

This will result clearly from the following considerations.

Stain: just like any other type of fibre, synthetic fibres are liable to be stained by liquids that fall upon them. However, when drying, however, it may happen that the stain of the carpet appears and retains these liquids, in which case the stain is difficult to remove. With Heraklon this does not occur because the stain is not absorbed and not as a result of special treatment of the fibre prior to its conversion into carpets.

Polypropylene fibre, in fact, is almost completely non-absorbent, as can be seen from fig. 3 which shows the percentage of water uptake for different fibres.

This means that the staining liquid remains on the outside of the fibre and can thus be removed by simple swabbing or by a water rinse, with no

four that traces will be left on the carpet.

In addition, the chemical nature of polypropylene also affords a further defence against staining. The low polarity of polypropylene prevents staining by water-soluble dyes permanently fixed to the carpet, and allows stains to be removed by the use of common solvents.

Dust: carpets, obviously, are subject to receiving the dust caused by normal services, and therefore required to be cleaned just like any other floor covering. Here, too, polypropylene has an advantage, since they can be washed without suffering from shrinkage, and moreover they dry very quickly because the water is not retained by the fibres.

3. Colour fastness

Granted that carpets are still sold and used as a long-lasting commodity, they are obviously expected to resist the too rapid deterioration of quality.

In particular, the customer expects the colour he chooses - which is perhaps one of the most important factors in deciding his purchase - to remain unaltered for a long time. There is no sadder sight than a faded carpet, or more attractive than one which shows signs of wear, exposure to light has been more or less intense.

Great attention is therefore paid by fibre manufacturers and carpet dyers to the problem of colour fastness. Colour fastness is not only important with respect to light, since resistance to fading and washing also plays a leading part in maintaining the carpet's appearance.

Polypropylene fibre is not dyeable by the methods normally adopted for other fibres, and must therefore be dyed by mixing the pigments to the stock polymer prior to extrusion of the fibre.

where in the past and that is why the staff of polypropylene fibre producers have tried to get a very wide range of colours in a limited number of shades. On the other hand it has assured to utilize the full range of its fibre in polypropylene fibre. The progress of the fibre in the past is not so good as a result of a change of technology, but the new technique allows the use of many more colours than in the past.

Lawrence has to be taken into account when studying and developing suitable fibres for carpets, which has recently been placed onto the market.

In fact, this new type was also required to offer converters and consumers the same quantities of colour fastness as when they were accustomed with spun-dyed Meraklon; through a study of dyeing methods and a selection of the most suitable dyes, we have thus produced a very wide series of recipes having a colour fastness practically equal to the excellent spun-dyed series.

With this progress, we have summarized the "basic" properties required of a fibre for carpets, and think it may be concluded that Meraklon polypropylene fibre is every right to be considered an excellent material for this purpose.

We shall now examine one peculiarity of Meraklon that has not been mentioned before, and it is very significant for the success of a floor covering only in some cases: we refer to "dimensional stability". As we have seen, a needle punched floor covering is a continuous isotropic structure composed of randomly distributed, entangled, cut fibres. It may, or may not, comprehend a ground fabric. Such a structure is able to expand and shrink in accordance with temperature and humidity of the surrounding atmosphere. It must be pointed out, though, that relative humidity can vary in a home within a range far wider than that of temperature variations and it is therefore relative humidity that controls the phenomenon.

The peculiar chemical nature of Meraklon gives the needle punched carpets made with this fibre a very high dimensional stability. Since polypropylene fibres are unaffected by moisture, they will not swell when relative humidity rises and will not shrink when it goes down. The needle punched structure will thus keep its original dimensions no matter how dry or damp

... floor covers. The floor covers are made of spun polypropylene
... rings can be used for floor covers, for example, which is
... little advantage.

In this project, the floor covers are made of polypropylene
... floor covers.

The sample was tested at a temperature of 100°C and
... relative humidity of 50%. The test results show that the
... operator, the floor covers are made of polypropylene in the
... general in the direction of longitudinal direction.
... sample was tested at a temperature of 100°C for
... hours. After the test, the floor covers (to the original
... positions) cross-sections were taken.

The sample was then tested at a temperature of 100°C, and measured
... no variation in the floor covers.

Identical test results were obtained for the floor covers of world-
... quality, μ W 1000.

- ... lower, 0.1 g/cm³ ...
- ... seawise, 1.0 g/cm³ ...
- ... seawise, 0.2 g/cm³ ...

Dimensional stability of the floor covers is very important. The floor
... rings are self-cleaning. The floor covers are made of polypropylene
... result in unpleasant odors. The floor covers are made of polypropylene
... synthetic bumps. The floor covers are made of polypropylene
... the floor covers has a high resistance to the floor covers
... anything else.

We have thus shown that the floor covers are made of polypropylene
... and the particular advantage of the floor covers is their
... rings.

We have seen that the floor covers are made of polypropylene
... table for such applications. We have also reported without pointing
... that Meraklon polypropylene floor covers are the best material, not as

- The wide availability of polypropylene resin
- The wide availability of machinery for its use
- The low cost of polypropylene resin.

If the wide availability of polypropylene resin, the relatively low cost of the fiber, and the wide availability of machinery for its use are the reasons for the punched carpet's success, it is likely that the production made at the beginning of the 1960s will be a good example of a low cost fiber.

The wide availability of machinery to produce commercially "low cost fiber" from polypropylene fibers.

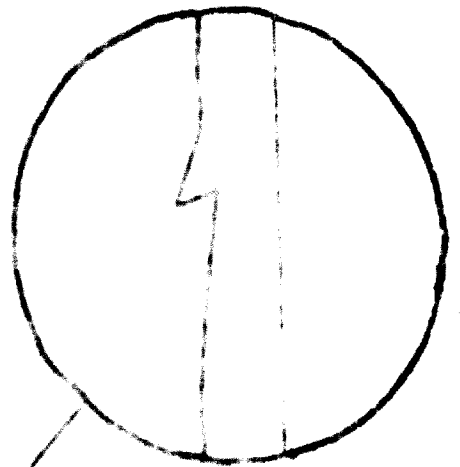
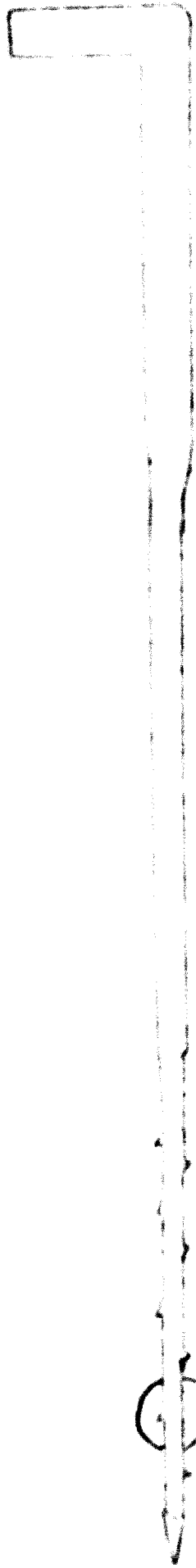
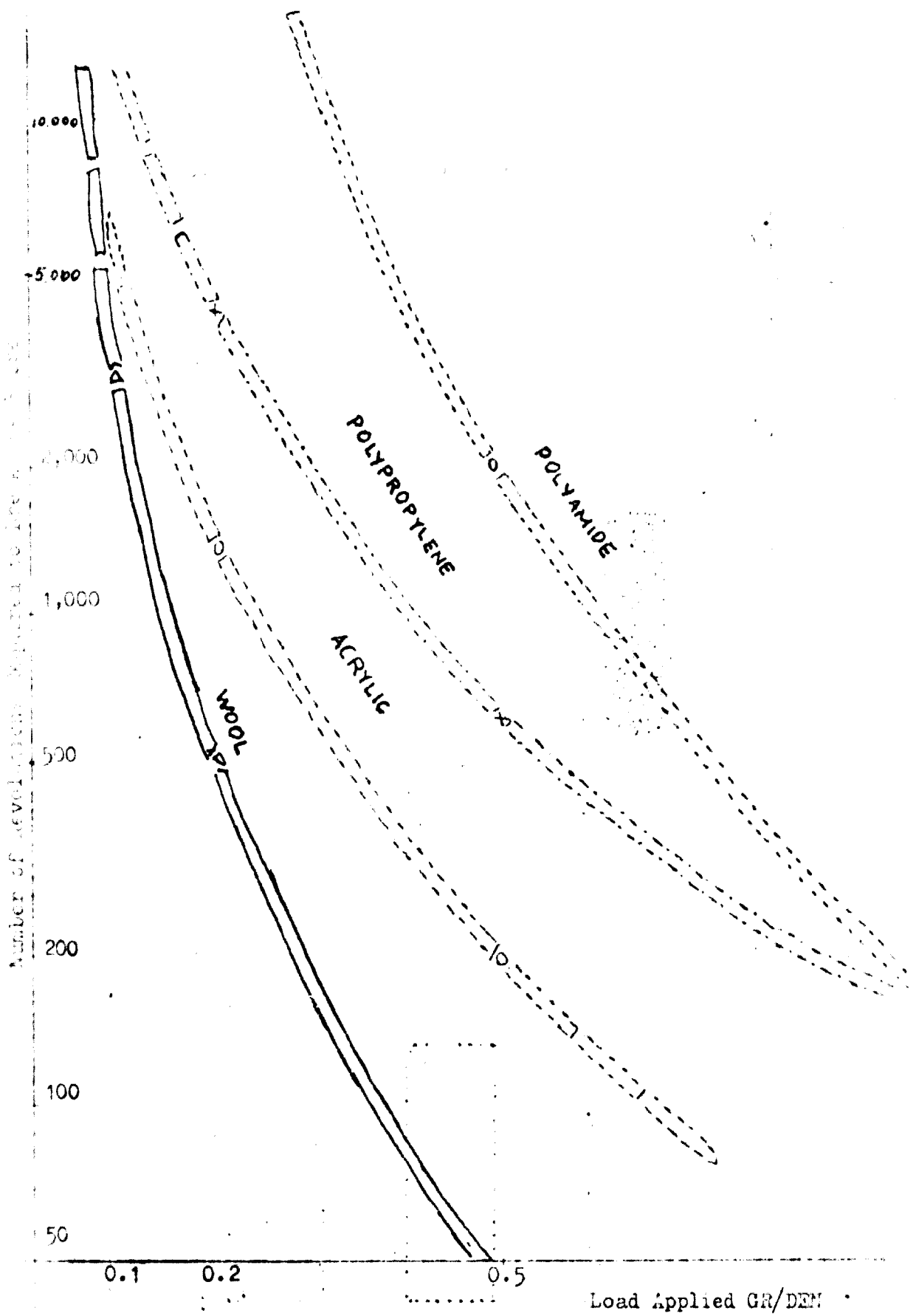


Fig. 1

Fig. 1

Abrasion Resistance of Single Filaments



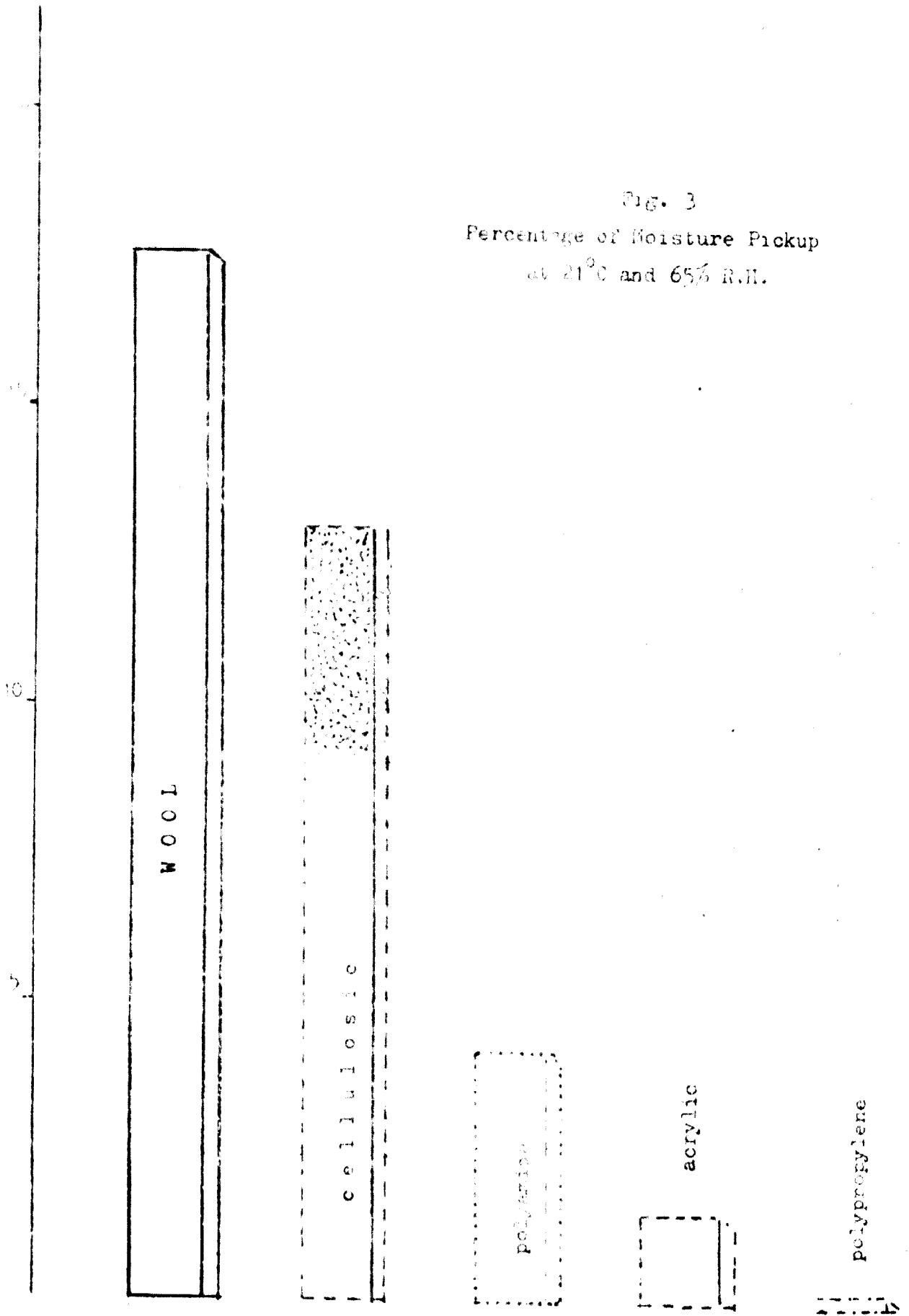
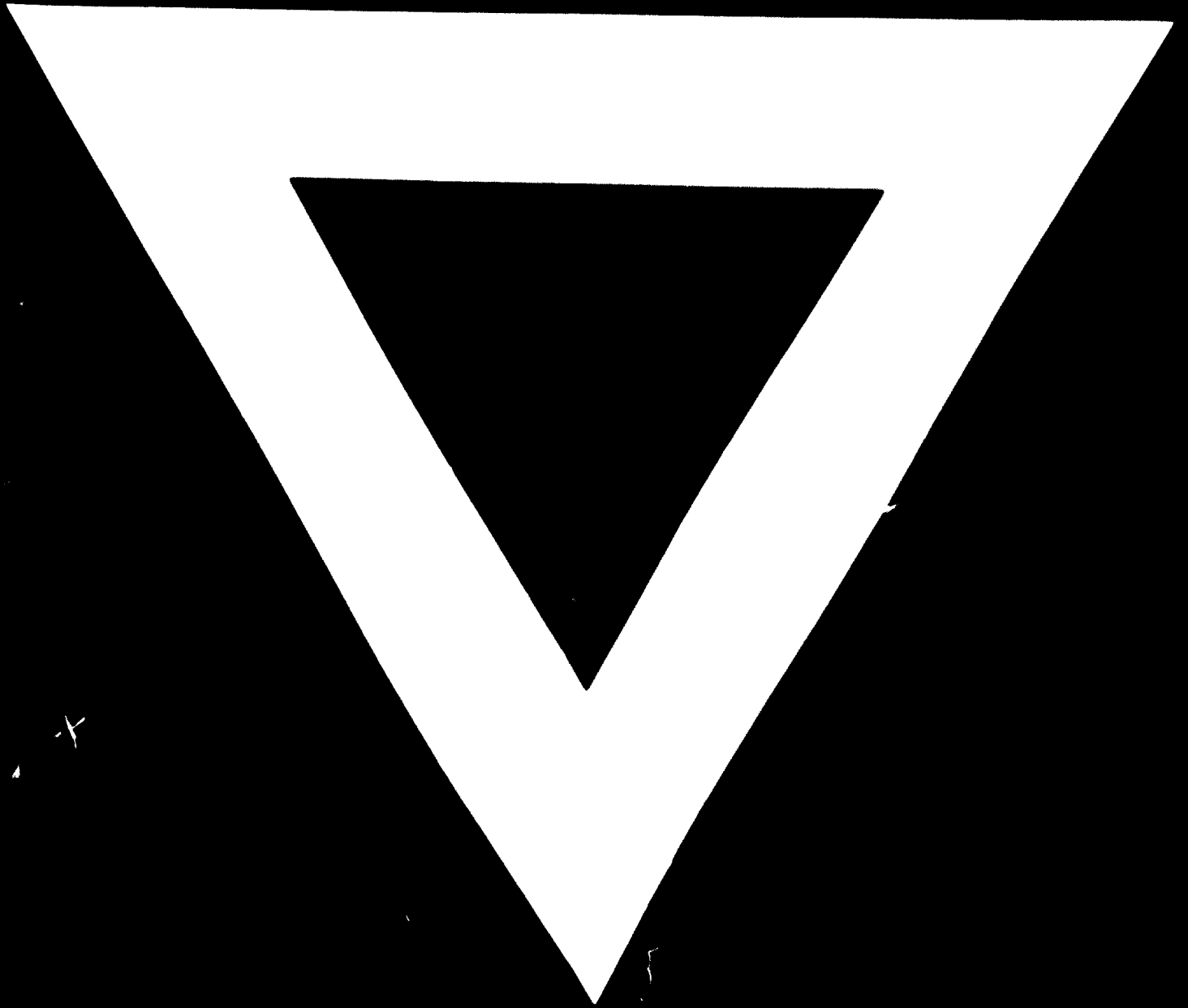


Fig. 3
Percentage of Moisture Pickup
at 21°C and 65% R.H.





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