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THE MICROBIOLOGICAL MONITORING OF RECYCLED PAPER TISSUES

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Abstract

In order to investigate the microbiological safety of sanitary tissues made of recycled scrap papers in Iran, random samples were taken for one year with the cooperation of the Iranian Standard and Industrail Research Institute (Karaj unit), of 44 types of sanitary tissues, two samples of each type including tissues, toilet papers and dipers as well as a control sample and their probable contamination with microbiological elements (bacterial & fungal) were assessed using proper ordinary and specific culture environments while also performing confirmation tests.

Considering all aspects of this study including easy identification, high precision, simplicity of application, economic justification and observation of better results, the method which applies ringer 1/4 solution as the thinner environment was preferable to the saline peptone water solution.

No contamination with *Staphylococcus aureus, Streptococcus faecalis, Pseudomonas aeroginosa* and *E.coli* bacteria was observed, but the excessive contamination with the mesophillic bacteria was confirmed.

Among the 27 samples tested with the ringer 1/4 method, 8 cases (29.6%) were excessively contaminated with the mesophillic bacteria and one case (3.7%) with fungi. Meanwhile, out of the 43 samples that were tested with the saline pepton water solution, there was no excessive contamination with mesophillic bacteria and only one case (2.3%) of fungal contamination was observed.

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Introduction

Paper is a matted or felted sheet, usually made of cellulose fibres, formed on a wire screen from water suspension. Although wood has become the major source of fibre for papermaking, rag fibres are still used for papar of maximum strength, durability and permanence. Recycled wastepapers (including newsprint) and paperboard are also important sources. Other fibres used include straw, bagasse (residue from crushed sugar cane), esparto, bamboo, flax, hemp, jute and kenaf.

Weight or substance per unit area, called basis weight, is measured in reams (now commonly 500 sheets) (3,7). Regarding the output of Mazandaran Wood and Paper Complex and the relating calculations, 0.13 square meters of wood is needed for producing one bundles of 100 gr paper and whereas a bail of paper included 12 bundles, the amount of wood needed for each bundle would be 1.54 square meters (6).

The output of paper mills, during the years 1993 to 1996, marks an average growth of 28.6% while the average growth of import has been 5% during the same period (1,2).

Sanitary tissues in Iran are produced by three factories named Latif with a nominal output of 15000 ton per annum, Harir-e-Khouzestan with a nominal output of 15000 ton per annum and Nozohour with a nominal output of 5000 ton per annum.

Recycled papers (print papers including those that are used for printing newspapers and books) and cardboards are regarded as significant sources of paper production.

A brief study of the constituents of home garbage in Iran reveals that 9% of it's contents is wastepaper that can be recycled. 60% of the paper used in Iran is distributed in Tehran. Considering 9% paper and cardboard in Tehran's garbage, one can say that up to 231300 tons of recycled paper can be produced in Tehran (4,8).

As recyclable materials including paper are not seperated in the origin, contamination with various microbial elements is probable and if careful hygienic requirements are not met in the production packing of sanitary tissues, they may endanger the consumers' health.

Materials and methods

44 pairs of samples including 19 samples of sanitary tissues, 15 samples of tissues, 3 samples of delsis, 5 samples of dipers and 2 samples of non-woven textiles with the control sample were taken.

Provinding the test sample: this was done by taking various samples from various parts and layers of the selected sample particularly those that were most prone to contamination so that it could be representative of the entire sample.

Making the test portion in two ways and in two thinner environmets: a) Cutting and collecting parts of the sample in undefined sized totally in 20 gr and entering the same in 180 ml saline peptone water solution (43 cases). b) Cutting pieces of the sample in 20 10 mm with a total weight of 2 gr and entering the same in ringer 1/4 solution (27 cases) and placing the test portion containar on the shaker for 15 min.

Out of the 44 samples that were surveyed, 26 were done with both methods using saline peptone water solution and ringer 1/4 solution as the thinner environments, 17 cases only with saline peptone water soultion and one case with the ringer method.

Placing one ml of test portion containing saline peptone water solution in the trypton soye agar culture environment and heating in 37 degrees centigrade for 48 hours for counting the colonies of mesophillic bacteria (Fig. 1, Table 2).

Placing one ml of the same test portion into the saburo dextrose agar culture environment and heating for 72 hours in 25 degrees centigrade for counting the colonies of fungi (Table 4).

Placing of 10 ml of samples from the ringer 1/4 (deviding into 5 plates, 2 ml for each one), into the plate count agar culture environment for 72 hours in 30 degrees centigrade for counting the total number of the microorgansims (Fig. 2, Tables 3,5).

Placing of 10 ml of each thinner environment, seperately into the specific environments of trypton soye broth, azide glucose broth, malachite green broth and brilliant green bile broth, for searching and identification of *Staphylococcus auerus, Streptococcus faecalis, Pseudomonas aeroginosa* and *E.coli* after 48 hours in 37 degrees centrigrade (Table 1).

Stastical examination : a) Using the Pair-t-test method to compare the different test portions (saline peptone solution and ringer 1/4) as a thinner environment for counting the colonies of mesophillic bacteria in the samples of tissues.
b) Meanwhile, a comparison was made between the two methods of preparing test portion using saline peptone water solution and ringer 1/4, for counting the colonies of fungi in the samples of the sanitary tissues by the Pair-t-test method.

Results and discussion

The results of the tests indicated that some of the recycled sanitary tissues and their products were contaminated by mesophillic bacteria and fungi, In this study, among the 43 cases tested with the saline peptone water soultion as a thinner environment, no contamination was observed. But among the 27 smaples tested with ringer 1/4 method, 8 cases (29.6%) were contaminated with the mesophillic bacteria.

Among the 43 cases tested with the saline peptone water solution, there was one case (2.3%) contaminated with fungi and also, there was one case (3.7%) among the samples tested by the method of ringer 1/4 solution.

None of the 44 samples were contaminated by *Staphylococcus aureus, Streptococcus faecalis, Pseudomonas aeroginosa* and *E.coli* bacteria.

As the recyclable materials including paper are not separated in the origin, contamination with various microorganisms (pathogens and fungi) is probable and if careful hygienic requirements are not met in the production and packing of the sanitary tissues, they may endanger the consumers' health.

Therefore, the type and amount of antiseptic materials used in the factories producing tissue must be precisely controlled. The chemicals used, must eliminate the microorganisms and leave no pollution of themselves.

It is much better to add the anticeptics to the pulp in several stages of the production, because the heat involved in drying and pressing is usually not enough to eliminate some of the pathogens. In surveying the results, it was seen that the contamination of the night shift was minimal and about zero while in the morning and afternoon shifts it was sometimes over the standards.

In order to find out the proper way of counting the colonies of mesophillic bacteria and fungi, the Pair-t-test method as a statistical test was used. According to this test, the two methods of saline peptone water solution and ringer 1/4 solution were compared.

Based on this test, the ringer 1/4 method, with a higher precision, is more suitable for counting the colonies of the mesophillic bacteria. But as far as counting the fungi, there is no difference between the two methods and the ringer 1/4 has no advantage over the other method.

Table 1- Results of microbial tests of each sample among the 44 collected tissues using TSB, AZ, MG and BG, as the culture media, with the colaboration of Iran Industrial Standard & Research: Institute, Karaj Unit (1998)

Bacteria / Microbial contaminant		+	-	Total
E.coli	Samples	0	44	44
	%	0	100	100
Strep. D	Samples	0	44	44
	%	0	100	100
Psued.	Samples	0	44	44
	%	0	100	100
Staph.	Samples	0	44	44
	%	0	100	100

Table 2- Results of microbial tests of each sample among 43 collected tissues using Saline peptone water for counting the colonies of the mesophillic bacteria, with the collaboration of Iran Industrial Standard & Research Institute, Karaj Unit (1998)

No. of the colonies of the mesophillic bacteria	Samples	%
≤ 200	43	100
> 200	-	-
Total	43	100

Table 3- Results of the number of the mesophillic bacteria among 27 collected samples of tissues, using the Ringer solution, with the collaboration of Iran Industrial Standard & Research Institute, Karaj Unit (1998)

No. of the colonies of the mesophillic bacteria	Samples	%
≤ 200	19	70.4
> 200	8	29.6
Total	27	100

Table 4- Results of the tests for fungi among 43 collected tissues, using the Saline peptone water solution as the diluted culture media, with the collaboration of Iran Industrial Standard & Research Institute, Karaj Unit (1998)

No. of molds	Samples	%
≤ 20	42	97.7
> 20	1	2.3
Total	43	100

Table 5- Results of the tests for fungi among 27 collected tissues, using the Ringer solution as the diluted culture media, with the collaboration of Iran Industrial & Research Institute, Karaj unit 1998

No. of molds	Samples	%
≤ 20	26	96.3
> 20	1	3.7
Total	27	100

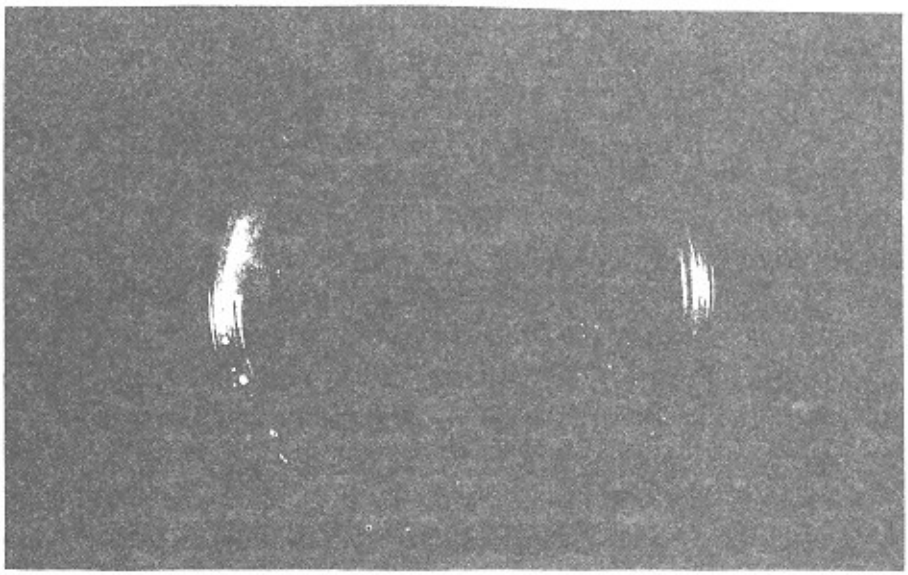

Fig. 1- The colonies of mesophillic bacteria from a sample of tissue after incubating in TSA media culture

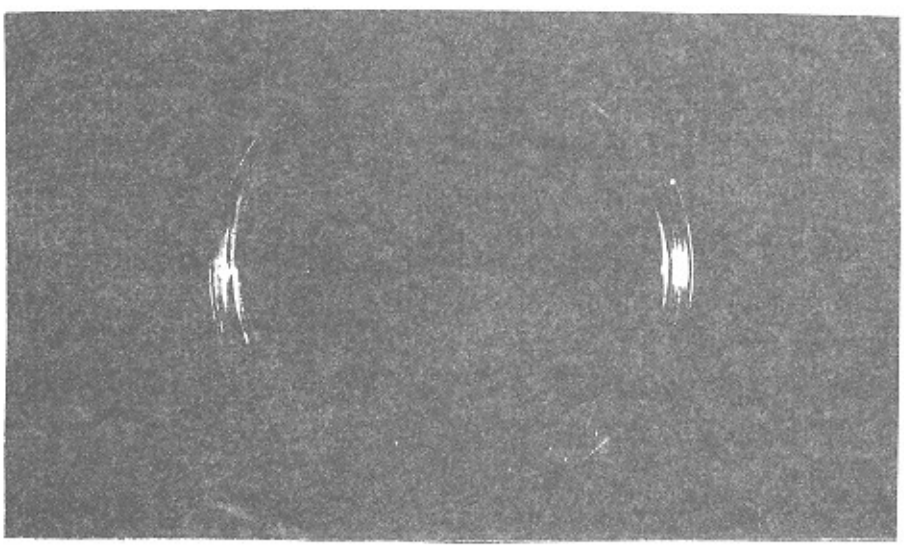

Fig. 2- The colonies of mesophillic bacteria and fungi (total microorganisms) from a recycled paper in PCA media culture

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