Evaluation of Quality Characteristics and Microbial Contamination of Saffron Samples Dried by Microwave

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Abstract

In this study, microwave technology in saffron drying has been investigated. To carry out this research, fresh saffron samples were treated with microwave in six different powers. Also one sample was dried by traditional method as a reference.

Comparison between microwave assisted drying with traditional methods was studied by measurement of color, aroma and flavor intensity, and also total microbial count, yeast and mold contamination according to standard methods.

The results showed that microwave dried samples were significantly better than the samples dried in traditional methods. So there was significant difference between the reference sample and the others whom treated by microwave ($p<0.01$). So it has been resulted that by using microwave energy, drying efficiency could be improved and microbial contamination of saffron samples would be decreased.

INTRODUCTION

Saffron is one of the most valuable spices that is obtained from drying stigma of flowers of *Crocus sativus* L. This product is one of the most important articles for agriculture and export in Iran.

Rate of contamination and microbial load are among main parameters of saffron quality that are considerably affected by conditions and length of drying time. In Iran the stigma of flower are dried mainly in rural areas producing the products by traditional methods which are inefficient and take a relatively long time. So application of methods that preserve quality parameters and reduce the time of drying and have lower contamination, could be very useful and effective, and can replace traditional methods.

In this research, using microwave for drying samples of fresh saffron and decontamination from dry saffron sample have been evaluated.

MATERIAL AND METHODS

Sample Preparation

1- Saffron flowers were harvested from Torbate heydarieh, a city in Iran. The stigmas of flowers were separated and dried in a microwave oven, with 6 treatments up to 7% moisture.
2- Saffron samples that had been dried with traditional methods were prepared and heated in microwave oven by six treatments just for a few seconds.

Treatments

1- Control. Without any heating
2- Microwave in low power (200 Watt)
3- Microwave in low-median power (400 W)
4- Microwave in median power (600 W)
5- Microwave in median- high power (800 W)
6- Microwave in high power (1000 W)

After any treatments, stigmas took place in glass jars to be examined.

Examination

Three major secondry metabolites, which are important for the high quality of saffron- crocin, picrocrocin and safranal- and microbial contamination- coliform, yeasts and total count- examined under standard methods.

RESULTS AND DISCUSSION

Results of chemical analysis of fresh saffron samples in six treatments have been shown in table 1 and results of decontamination analysis of dry saffron have been shown in table 2. Of all results of analysis of variance with Duncans Multiple range test and in $P>0.01$, mean comparisons were determined results obtained from this comparison have been shown in Figures 1 to 12.

Drying Fresh Saffron by Microwave

Picrocrocin. With respect to Figure 1 heat of microwave causes significant reduction in rate of picrocrocin but final rate is higher of minimum picrocrocin acceptable for first class saffron.

Safranal. With respect to Figure 2 it is evident that rate of safranal in control sample is higher than microwave treatments with a significant difference and there is no significant difference among 5 microwave treatments.

By evaluating Figures 1 and 2 it is shown that use of microwave due to its thermal integrity cause Picrocrocin decomposition, but obtained Figure are in the approved limit of standard for first class saffron (This limit is 20 to 50 for safranal and for picrocrocin is higher than 70).

Crocin. Figure 3 related to color intensity shows that rate of crocin in control sample is least, in the other words, drying saffron in microwave causes better preservation of color factor (crocin) in saffron. On the other hand, samples that have been dried in higher powers of microwave with respect less time needed have not shown a considerable reduction in rate of crocin.

Coliform. Figure 4 shows that microwave method has superiority in complete elimination of coliform contamination from saffron sample. All powers used in complete elimination have been effective.

Mold and Yeast. Figure 5 shows that drying with microwave causes complete elimination of mold and yeast contamination.

Total Count. Figure 6 shows clearly that there is a considerable and significant reduction relative to control sample. It also shows effectiveness of microwave method application in saffron drying and obtaining sample with minimum contamination.

Decontamination of Dried Saffron with Microwave Oven

Picrocrocin. Figure 7 shows the effect of decontamination treatments of dried saffron with microwave oven on rate of picrocrocin rate of sample picrocrocin that in equal times has been exposed to different powers from 200 to 1000 show no significant difference with control sample.

Safranal. Figure 8 shows the effect of decontamination treatments of dried saffron with microwave oven on rate of safranal in samples. The figure also shows that except for treatment 6 that sample have been affected by highest power of microwave, there is no significant different among other treatment and control sample.

Crocin. Figure 9 shows that application of power 1000 causes a significant reduction in coloring power of sample in comparison to control but there is no significant difference in other treatment. This figure shows that microwave has no adverse effect on saffron quality with respect coloring power, color and bitterness, and by selecting correct conditions negative effects will be minimum.

Coliform. Figure 10 shows that highest contamination related control treatment and there is least rate of coliform because of high powers of microwave.

Mold and Yeast. Figure 11 shows clearly that use of low and medium powers has no significant effect in reduction of mold and yeast while the least of rate of other

contamination with significant is related to treatment high power.

Total Count. Figure 12 shows that difference in microbial total count among microwave treatments is non significant and among microwave treatment and control is significant.

In other words, microwave ray in elimination of contamination in dried saffron of sample has been completely successful.

CONCLUSION

Tests conducted in every stage in treatments of saffron drying and treatments of decontamination show positive effect microwave rays in elimination of contamination and show its significant reduction, mean while no evident effect has been observed in qualitative properties of saffron. These results are important in decontamination of dried saffron sample that is one of the main problems of export of this product. By designing industrial tunnels of microwave in addition to drying saffron in season of production, it is possible to decontamination dried saffron in other season with microwave and then it can be packaged.

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Tables

Table 1. Result of chemical and microbial analysis of fresh saffron sample dried microwave

No. of treatment	Picrocrocin	Safranal	Coloring Power	Coliform	Yeasts and mold	Total count
1	75	35.3	209.8	22×10^3	40×10^3	17.5×10^3
2	73.1	37.7	218.5	—	—	50×10^3
3	70.6	30.2	220.2	—	—	6×10^3
4	73	30.5	230	—	—	2.5×10^3
5	73	31.4	234.5	—	—	6×10^3
6	72.2	30.7	233	—	—	3×10^3

Table 2. Result of chemical and microbial analysis of dried samples decontaminated by microwave

No. of treatment	Picrocrocin	Safranal	Coloring Power	Coliform	Yeasts and mold	Total count
1	78.2	38.1	206.7	7×10^3	25×10^3	17×10^3
2	79.7	38.8	210.2	1×10^3	2×10^3	12.5×10^3
3	76.1	37.4	205.2	5×10^3	3×10^3	14×10^3
4	79.2	38.3	215.5	2×10^3	1.5×10^3	15×10^3
5	78.2	40	216.6	0	1×10^3	4×10^3
6	75	53.6	192	0	0	0

Figures

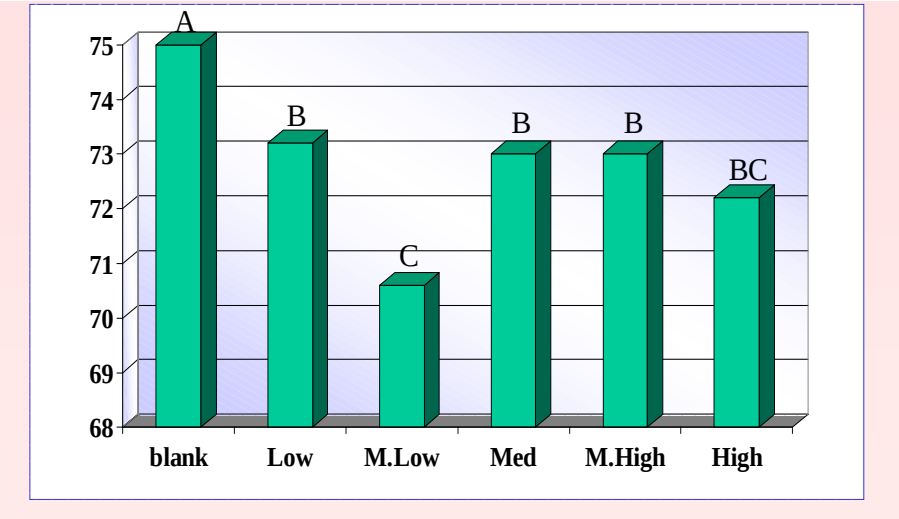

Fig. 1. Picrocrocin, drying with microwave oven

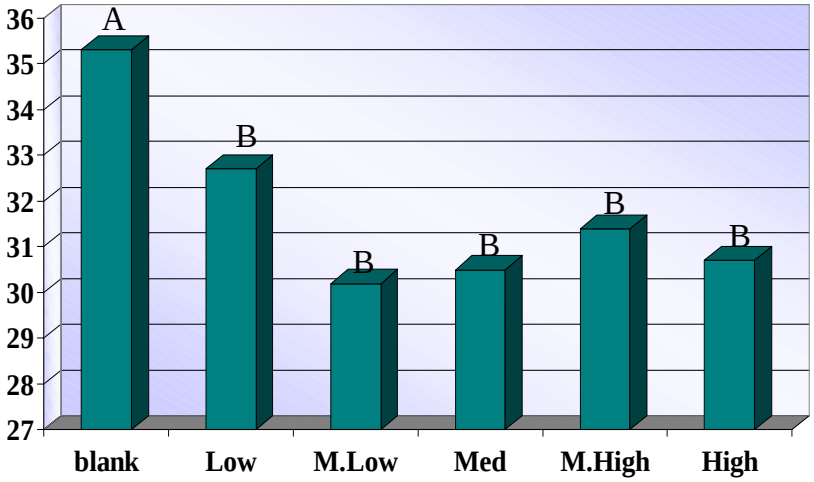

Fig. 2. Safranal, drying with microwave oven.

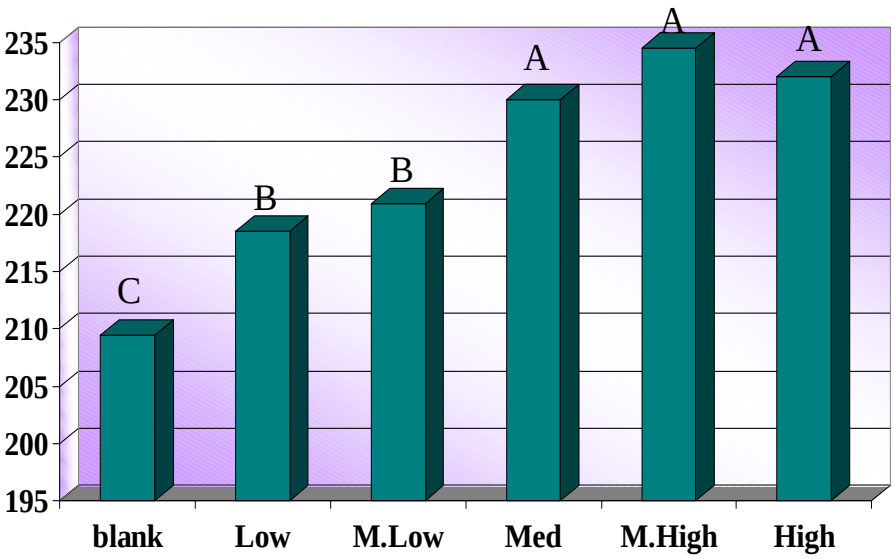

Fig. 3. Crocin, drying with microwave oven

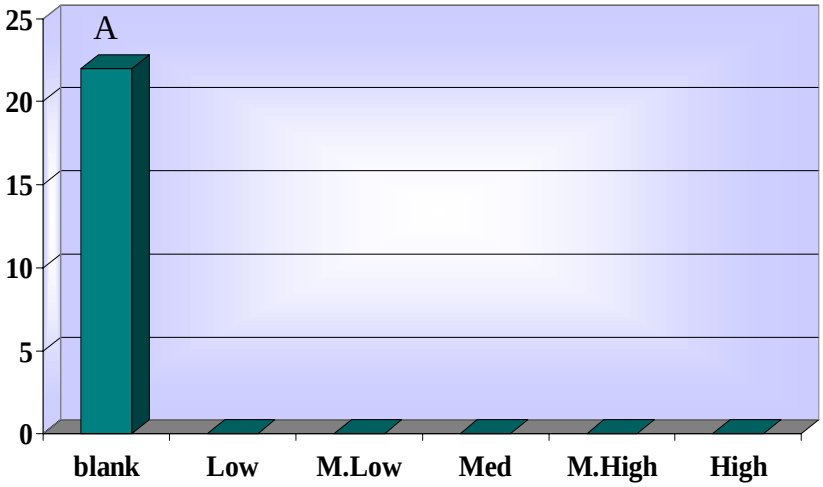

Fig. 4. Coliform/1000, drying with microwave oven.

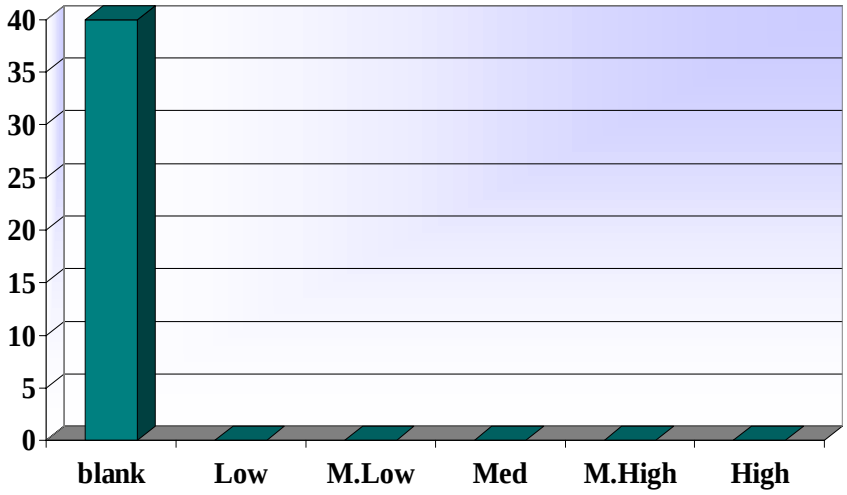

Fig. 5. Yeast/1000, drying with microwave

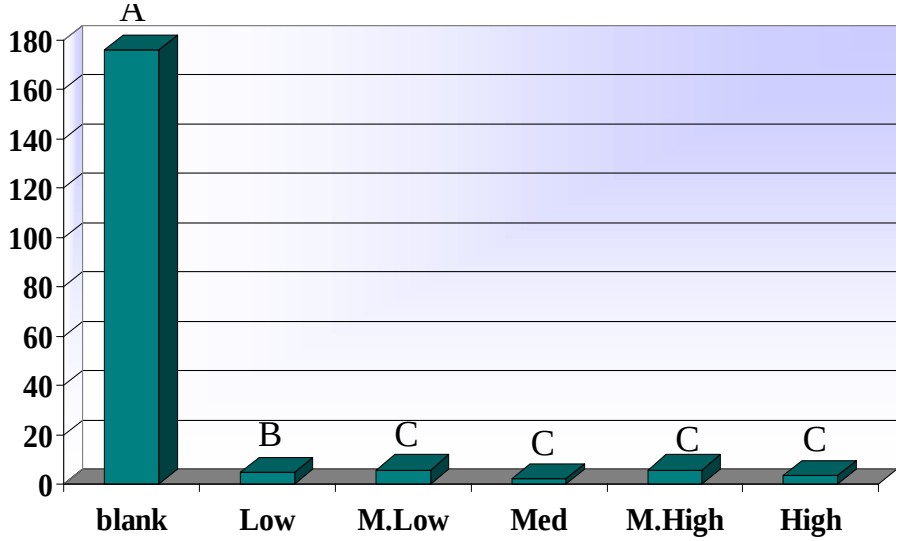

Fig. 6. Total count/1000, drying with microwave oven

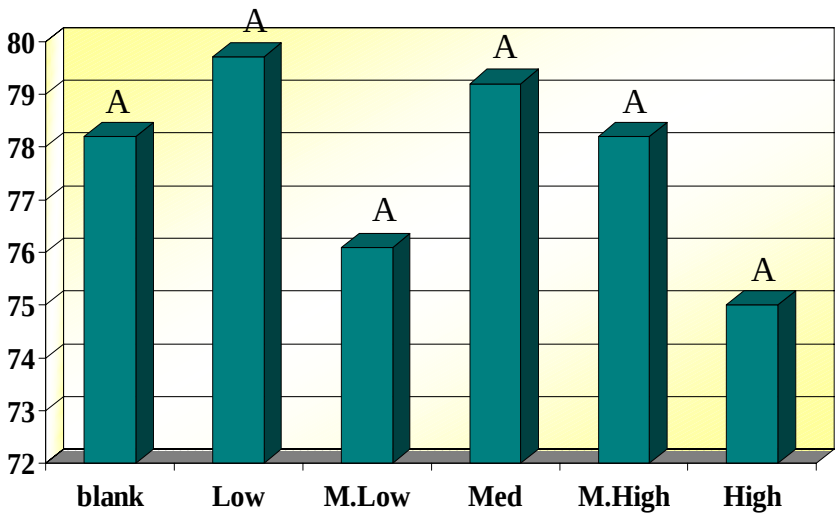

Fig. 7. Picrocrocin, decontamination with microwave

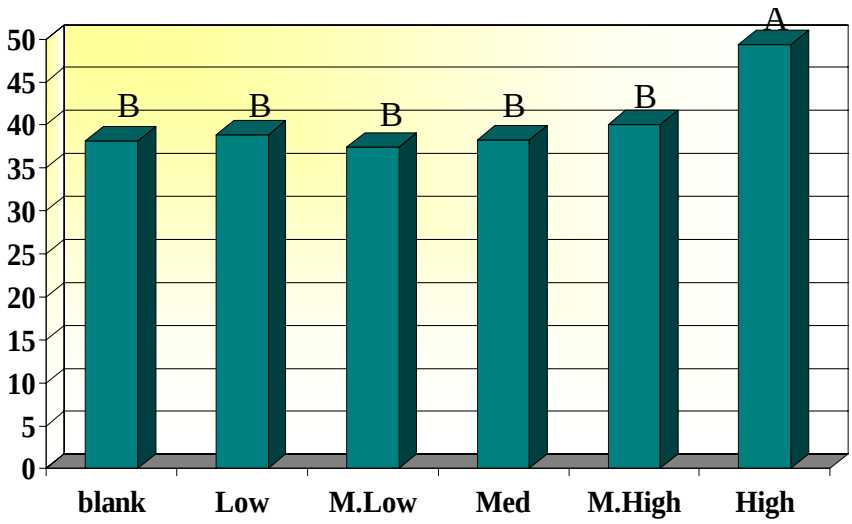

Fig. 8. Safranal, decontamination with microwave

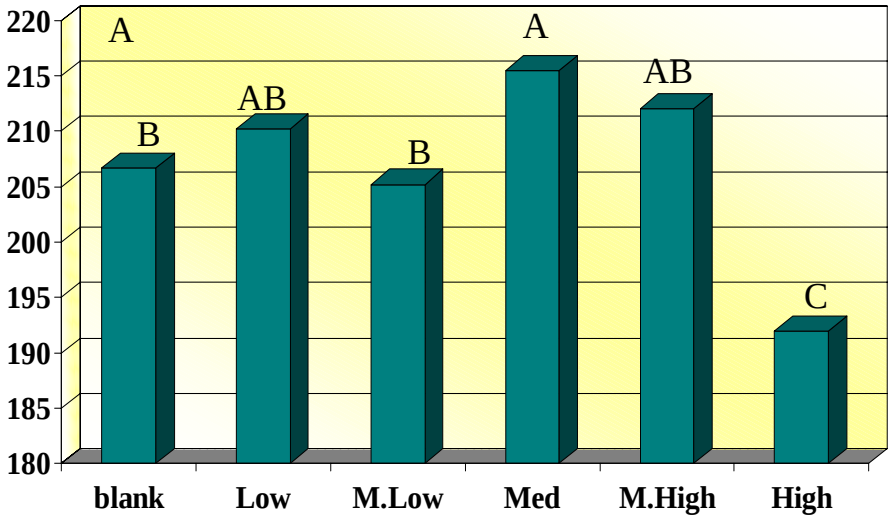

Fig. 9. Crocin, decontamination with microwave.

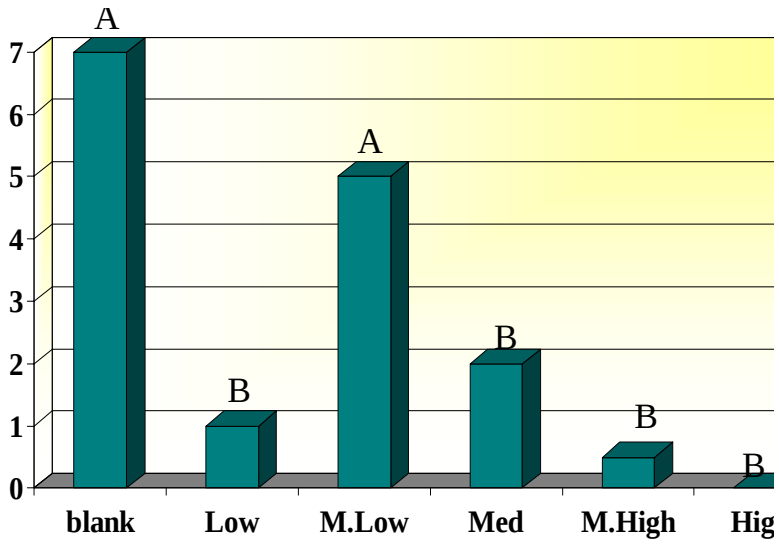

Fig. 10. Coliform, decontamination with microwave

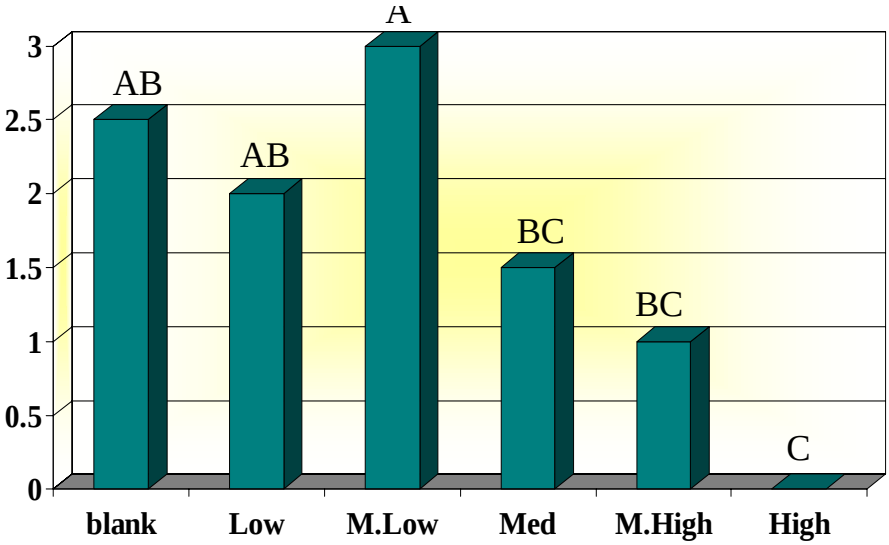

Fig. 11. Yeast/1000, decontamination with microwave

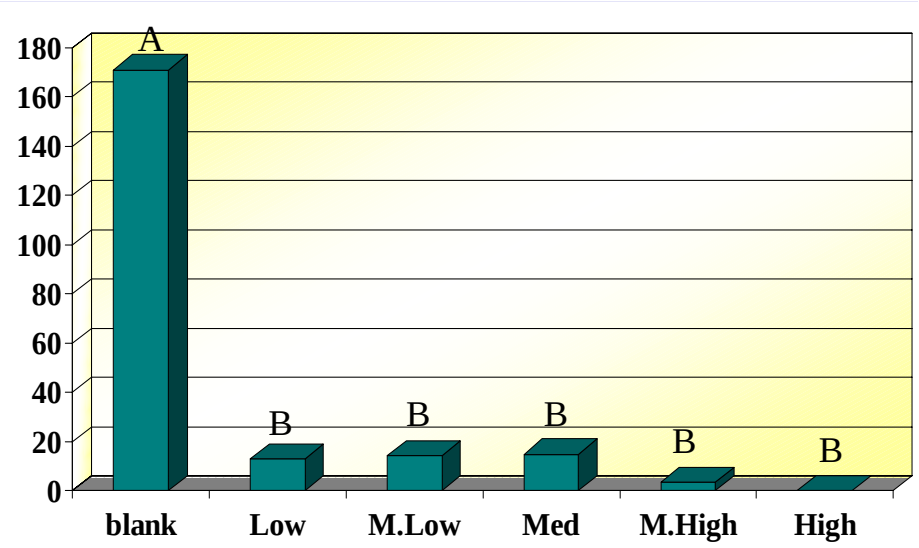

Fig. 12. Total count/1000, decontamination with microwave