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BLOOD POWDER IRRADIATION FOR IMPROVING HYGIENIC QUALITY

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SUMMARY:

Microbiological stability of blood powder (red fraction of cattles blood) was obtained using gamma irradiation. Doses of 2 kGy, sufficient to eliminate enterobacterial coun decrease the total flora to a level below 10^3 c.f.u.g^{-1} in samples evaluated during a year storage in polyetilene pouches at room temperature. Yeasts and moulds were not detected dur storage. No growth of bacteria was detected when doses of 6 kGy were applied.

INTRODUCTION:

Blood powder has become an important source of protein and biodisposal iron for human consu tion. Experiments have been developed to add it to meat products, biscuits, etc. (Fernan et. al. 1990).

Although attention is devoted to microbial contamination of blood collection, total flora liquid blood varies between 10^4 to 10^5 c.f.u.g^{-1}.

According to hygienic regulations raw materials of natural origin for oral pharmaceuti products have to meet a high microbiological grade. Total flora must not exceed 10^3 c.f.u. (NC-121, 1985), therefore the present paper deals with the use of gamma radiation to impr hygienic quality of blood powder.

MATERIALS AND METHODS:

Cattle blood was separated by centrifuging into two fractions. The red fraction was then s dried, packed in polyethylene pouches (100g each) and irradiated at room temperature. irradiation process was carried out in the Food Irradiation pilot plant of the Instit using a cobalt-60 source. At the beginning of the experiments, the initial activity of source was 1,5 PBq.

The dose distribution and the calibration function of the plant were determined with aqueous ferrous sulphate (Fricke) system. The dosimetry solution and the spectrophotome measurements were made by using the common standard procedure (IAEA, 1987). The min absorbed dose rate in the irradiation positions was 16.950 Gy/min. The value of the dose formity ratio, U (the ratio of maximum to minimum absorbed dose in the product) was 1.16. routine dosimeter used for assisting irradiation process control was ethanol-monochlorobe (Kovac et. al., 1984). Irradiation treatments were different in minimum dose. Intervals fluctuated from 0,1 to 25 kGy (those including food conservation dose and radio-sterilizat dose of pharmaceutical products), but dose increasing was selected according to the ini flora. The higher microbial initial count of blood powder samples was 10^4.

After irradiation treatments, samples were taken for microbiological analysis. Plate co were made of mesophilic aerobes (plate count agar 35 ± 1^0C 48h), enterobacterial counts + 1% dextrose, 37^0C, 24h), yeasts and moulds (Malt extract agar, 30^0C, 5 days), MPN of sp

formers aerobes (dextrose triptone broth, 37°C, 72h) and MPN of spore-formers anaerobes (liver broth 37°C, 72h).

Irradiated samples, stored at ambient temperature (25-30°C) were examined (each three months during a year) for the same microbiological analysis. Possible changes in water solubility were measured to the samples by centrifuging method (UNIIAP, 1976).

RESULTS AND DISCUSSION:

Table 1 shows doses value of routine control of irradiation process (ethanol-monochlorobenzene) method); accordance between expected value and measured value is observed.

Figures 1-3 present the reduction of microbial flora (mesophilic aerobes and enterobacterial counts) according to initial contamination. Initial flora of 10^4 was eliminated by using 6kGy doses. Similar results were reported for Uchman et. al. (1986-I) in blood powder plasma. If the microbial quality of the blood is higher (total count of 10^2 c.f.u.g^{-1}) only 4 kGy are sufficient to eliminate the counts (Fig. 3). As observed, Enterobacteriaceae present in levels of 10^1-10^2 were eliminated with doses up to 2 kGy. These results are in agreement with those reported for Mossel (1966) in dry mixed feed ingredients.

Counts of yeasts, moulds and spore-formers were not detected in irradiated samples.

Table 2 shows the behaviour of the samples during storage. No growth of Enterobacteriaceae was detected when doses of 3kGy were applied; the count of these organisms decreased as storage period advanced in unirradiated samples; obviously due to ecological requirements not present in the substratum.

The results of spore-formers were quite different as indicated in table 2. At the beginning of the storage, no growth of these organism was appreciated, however as storage increased, counts were obtained from 0,5 and 1,0 kGy samples and unirradiated ones. Only aerobes spore-formers were detected; the same results were also obtained by Turjanski et. al. (1966).

The absence of mesophilic aerobes in 6kGy irradiated samples remained during storage.

Fig. 4 presents the relationship between water solubility and irradiation doses. Water solubility was reduced to the half with doses of 25 kGy, similar results were obtained by Uchman et. al., (1986-II).

CONCLUSIONS:

Gamma radiation improves the microbiological quality of blood powder. Total bacterial counts can be reduced to less than 10^3 c.f.u.g^{-1} when doses of 2 kGy are applied. The same doses eliminate enterobacterial counts. During a year of storage no growth was detected when irradiation doses of 6 kGy were applied. Doses of 25 kGy reduce water solubilities of blood powder to the half. Irradiated blood powder satisfied microbiological requeriments for boths: foods and pharmaceutical products.

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Table 1 Results of the dose measurements with the ethanol-monochlorobenzene system.

D_{min} (kGy)		D_{max} (kGy)	U
Expectec	Measured*	Measured	
2	2.10 (0.151)	2.62	1.25
5	5.00 (0.226)	5.85	1.17
10	9.51 (0.506)	11.41	1.20
25	26.01 (1.000)	28.61	1.10

* The number of determinations for each single value was 3; the values in the brackets are standard deviations.

Doses	NMP aerobes mesophilic spore-formers Time (months)					NMP anaerobes thermophilic spore-formers Time (months)				
(kGy)*	0	3	6	9	12	0	3	6	9	12
Control	NG	0.84	0.69	2.07	2.30	NG	0.70	0.90	1.07	1.30
0.5	NG	9.90	1.04	1.48	1.60	NG	NG	NG	NG	NG
1.0	NG	NG	0.84	0.95	1.60	NG	NG	NG	NG	NG
2.0	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
4.0	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
5.0	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
6.0	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG

NG No growth

* The given results belong to samples in which any growth was obtained

Table 2 Behaviour of blood powder during storage. Count of bacteria ($\log_{10}$ u.f.c.g^{-1}).

Doses	Enterobaterial count Time (months)					Total mesophilic count Time (months)				
(kGy)*	0	3	6	9	12	0	3	6	9	12
Control	2.84	NG	NG	NG	NG	4.68	3.70	3.04	2.58	2.30
0.5	2.04	NG	NG	NG	NG	3.91	2.51	2.01	1.70	1.84
1.0	1.48	NG	NG	NG	NG	3.04	2.00	1.84	1.60	1.70
2.0	NG	NG	NG	NG	NG	2.83	1.60	1.70	1.78	1.60
4.0	NG	NG	NG	NG	NG	1.90	1.70	1.60	1.30	1.60
5.0	NG	NG	NG	NG	NG	1.48	1.60	1.60	1.30	1.48
6.0	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG

Fig. 3 Reduction in microbial counts

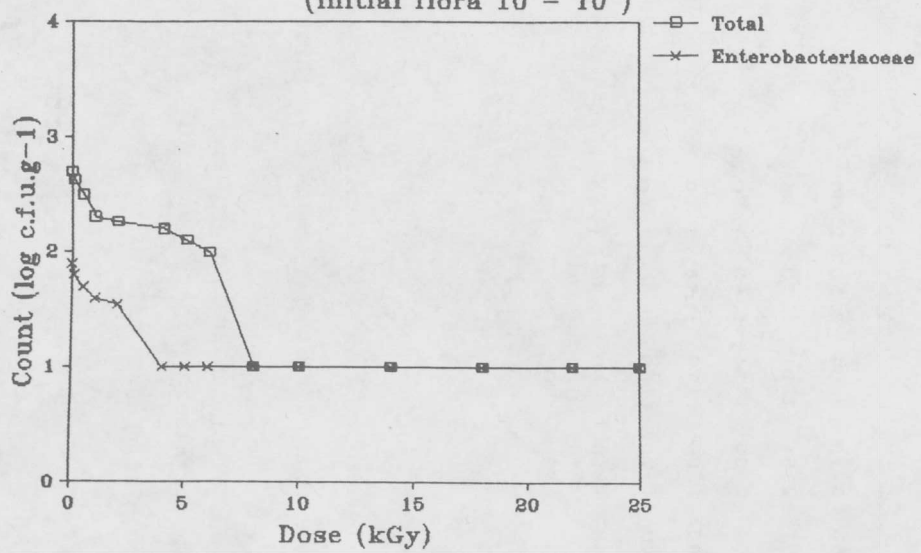

Fig. 1 Reduction in microbial counts

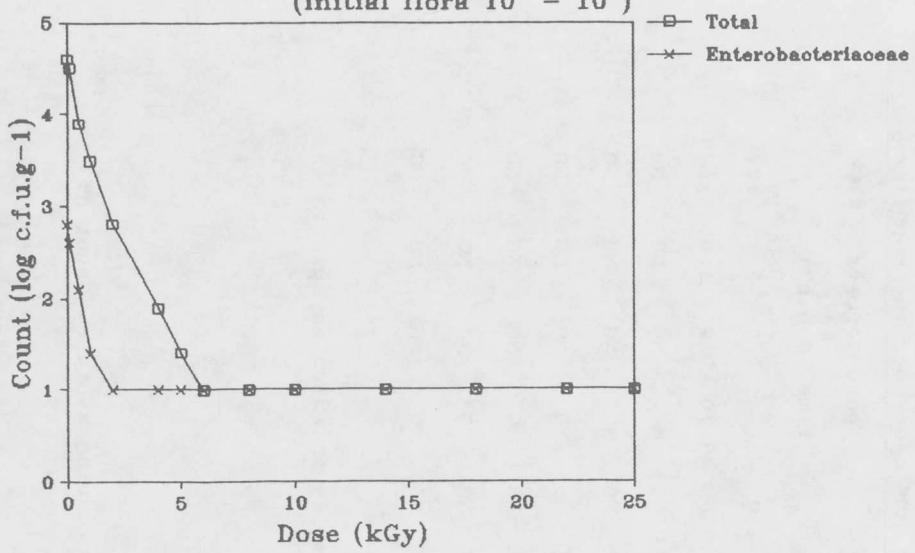

Fig. 4 Water solubilities vs. Dose

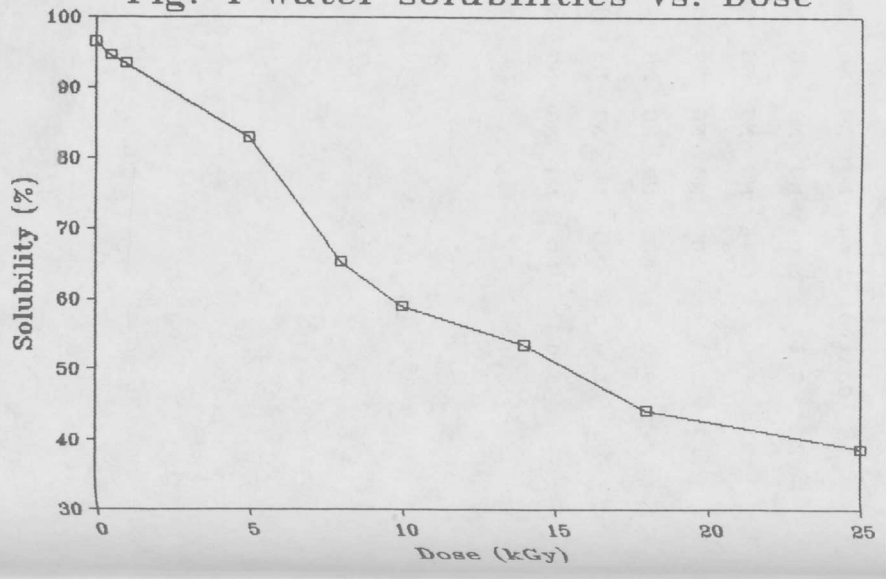

Fig. 2 Reduction in microbial counts