4:5

Pollution Control of Cooking Liquor from Abbatoir Offal and Meat Waste by Ultrafiltration:a Derived Source of Animal Protein and Nutritional Broth for Microbial Culture Media

A.S. BARRETO, MARÍLIA F. FERREIRA, JAQUELINA S. OUAKININ, A.M.R. RIBEIRO
Universidade Técnica de Lisboa. Faculdade de Medicina Veterinária. Rua Gomes Freire, 1199 Lisboa Codex. Portugal.

SUMMARY:

Filtration at 2 bar by a 10,000 Dalton polysulfone membrane of a deffated meat and offal abbatoir waste cooking broth has produced a depolluted permeate (less than 10 mg of total suspended solids and BOD5 120 mg O_2/l) and equal volume of a protein concentrated retentate.Upgrading and full utilization (zero effluent) has been achieved of both permeate and retentate, the former as a performant nutrient broth for microbiological cultura media, the latter as a protein enriched (5% w/w) formulation water for a batch of intermediate moisture food prepared with the related cooked meats and offals.

INTRODUCTION:

The utilization of reproved meats and offals in abbatoir operation implies a high temperature processing to destroy microorganismes, toxins and enzymes. Cooking broth therefrom is a heavy pollutant; even deffated, it has a high content in both BOD5 and suspended solids precluding their emission in the public sewage network.

Ultrafiltration is an operation which concentrates suspended solids and protein in the retentate and provides a depolluted permeate. To afford the cost of this operation the retentate with improved solids and protein content, can be incorporated in the meat meal cake or fully utilized as an enriched formulation water for intermediate moisture food (IMF) if a suitable balance of permeate/retentate is achieved for this purpose. The pH, nitrogen, phosphorus and potassium content of the permeate, which obviously includes small amounts of nucleotids, purine and pyrimidic bases and B-group vitamins, provide a valuable nutrient broth for microbiological culture media. Our aim is to upgrade both retentate and permeate in the above mentioned way.

MATERIALS and METHODS:

Meat and viscera rejected by the veterinary abbatoir inspection, including mainly lean meat, lungs, livers and un-marketable offals (bloody meat trimmings, udders and tallow) were pressure cooked in 30% their weight of water at 121°C for 120 minutes (to reach 120°C for 30 minutes in the cold point). The cooked meats were drained and grinded and processed into IMF for dogs (Barreto et al., 1989); the broth was chilled to 10°C, strain deffated, analysed for total suspended solids and BOD5 according to Anonimous (1960), and for dry matter, raw protein (Nx6.25), fat and ash according to AOAC methods (1960), re-heated to 45°C and filtrated at 2 bar in 10,000 dalton polysulfone membrane in order to get half the volume in the retentate (because that was the average volume of the enriched formulation water necessary to incorporate the wh

le mass of the correspondent cooked meats into a batch of IMF of the pre-set composition presented in Table 1.

Both retentate and permeate was analysed for dry matter, raw protein (Nx6.25), fat and ash. Total suspended solids, BOD5 (5 days at 20°C) were determined only on the permeate(Table 2).

The permeate was used to prepare the four most consumed media in food and water analysis by replacing the water and the meat extract in their formulae. Ten analysis of water and food according to Standard Methods of American Public Health Association (1960 and 1984), and plate counts of two suspensions of Staphylococcus aureus coagulase positive has been performed using the experimental media and their commercial counterparts, at the same time, featured by the same person to compare results.

RESULTS and DISCUSSION:

Figures in Table 2 show the ultrafiltration of the cooking broth enables both to control the pollution of a heavy pollutant effluent and to upgrade the retentate as a source of high valuable protein to incorporate in meat meal or in IMF.

The half and half retentate and permeate enable a double upgrading: the retentate as enriched formulation water of an IMF, providing 6% of the raw protein; the permeate as a nutrient base for microbiological culture media with zero effluent, zero pollution.

The culture media prepared with the permeate perform as well as the correspondent commercial ones as shown in Tables 3, 4, 5 and 6.

CONCLUSIONS:

Ultrafiltration is a convenient way to reduce the pollutant charge of the deffated broth from reproved meat and offal cookers. The cost of this operation is amortized by upgrading the retentate as a source of protein for animal feed and the permeate as nutrient base to preparation of microbiological culture media.

REFERENCES:

1. Anonimous (1960). Official Methods of Analysis, edited by the Association of Official Agricultural Chemists, Washington, DC

2. Anonimous (1960). Standard Methods for the Examination of Water and Wastewater, a edition of the American Public Health Association, New York, 19, N.Y., USA

3. Anonimous (1982). Manual Oxoid, Oxoid Ltd. Wade Road, Basingstoke, Hampshire, RG240PW,UK

4. Anonimous (1984). Difco Manual. Difco Laboratoires Inc., Detroit, Michigan 48232, USA

5. Barreto, A.S. and Ribeiro, A.M.R. (1989). Abbatoir By Products as a Semi-Moist Pet Food. Proc. of the 35th International Congress of Meat Science and Technology, III vol. 938-943, Copenhagen, Denmark.

Table 1 - Intermediate Moisture Food Composition

Raw Materials		Additives		Chemical composition	
Udders (cow)	20	Propyleneglycol	3	pH (20°C)	5.70
Tallow	10	Bi-calcium phosphate	1.6	aW (25°C)	0.89
Livers (cattle)	10	Citric acid	0.6	Moisture	35.0%
Lungs (swine)	10	Carrageen	0.6	Raw protein	23.0%
Retentate	8	Salt	0.5	Fat	13.0%
Reproved beef	4	Potassium sorbate	0.3	Carbohydrates	24.5%
Fat-free soya meal	33	Meat flavour	0.05	Ash	4.5%
Rice grits	5.5	Dye (Ponceau 4R)	0.025		
Premix	0.06	Butyl-hidroxyanisol	0.020		
		Butyl-hidroxytoluene	0.020		
		Dried garlic	0.015		

Table 2 - Chemical composition

	Dry matter %	Raw protein %	Fat %	Total ash %	BOD5 mgO_2/l*	TSS mg/l**
Deffated liquor	5.7	3.56	0.1	0.70	3000	4000
Retentate	10.2	5.05	0.4	0.68	--	--
Permeate	3.1	0.78	0.0	0.65	120	10

* BOD5 - Biochemical Oxigen Demand (5 days at 20°C)

** TSS - Total Suspended Solids

Table 3 - Enumeration of Staphylococcus aureus by plate count on tellurite glycine Baird-Parker Medium

	Commercial	Experimental
Suspension of strain 1 coagulase + (CFU/cm^3)	$120x10^6$	$119x10^6$
Suspension of strain 2 coagulase + (CFU/cm^3)	$115x10^7$	$116x10^7$

Table 4 - Enterococcus group, Most Probable Number in 100 cm^3 of water (presumptive test in azide dextrose broth)

Table 5 - Coliform group bacteria, Most Probable Number in 100 cm^3 of water (presumptive test in lactose broth)

Nº Analysis	Table 4		Table 5	
	Commercial	Experimental	Commercial	Experimental
1	< 2	< 2	21	33
2	< 2	< 2	12	14
3	< 2	< 2	9	9
4	2	2	7	5
5	4	6	< 2	< 2
6	7	9	2	4
7	5	5	< 2	< 2
8	9	12	< 2	< 2
9	< 2	< 2	5	5
10	9	8	5	7

Table 6 - Total Plate Count (Colony Forming Units per gram) in Tryptone Glucose Extract Agar

Nº Analysis	Commercial	Experimental
1	40×10^4	49×10^4
2	11×10^4	12×10^4
3	65×10^3	70×10^3
4	90×10^3	11×10^4
5	86×10^3	76×10^3
6	71×10^4	75×10^4
7	93×10^4	10^5
8	37×10^4	42×10^4
9	54×10^3	63×10^3
10	68×10^3	75×10^3