J. Int. Environnemental Application & Science, Vol. 3 (3): 175-179 (2008)

Risk assessment and risk decrease of contamination of waters with blood in slaughter industry. Part II: Risk decrease

Lyubomir VLADIMIROV[1]

University of Ruse, Industrial Faculty, 7017 Ruse, BULGARIA

Received April 30, 2008; Accepted June 2, 2008

Abstract: This paper presents a technology for utilization of animal blood, which is waste product in slaughter industry. By this technology blood-and-milk fodder concentrate with high protein amino acid content is obtained. The paper describes the basic technological processes and operations, their sequence, interrelations, some characteristics and modes. Comparative analysis of this technology and its previous versions is made in order to prove its higher efficiency. This technology has significant ecological effect since it prevents disposal of blood and pollution of wastewaters and respectively water reservoirs.

Key words: environmental protection, waste utilization technology, slaughter blood

Introduction

Blood is the main pollutant of sewage waters in slaughter industry. In the process of transition from centralized economy to market economy the small-size and medium-size production business has intensified. The number of small slaughterhouses, meat processors and sausage-makers increased. Few of them have appropriate wastewaters purification systems, which results in uncontrolled and increased pollution of water reservoirs.

An efficient approach to environmental protection in such enterprises is the implementation of waste less blood utilization technology.

Materials and Method

Blood is suitable raw material for manufacture of feedstuffs. Such products are blood powder, blood meal, fodder mash, blood-and-milk protein concentrate, etc. (Tomov & Baychev, 1999; Tomov *et al*., 2000; 2005).

Blood utilization prevents unspecified disposal of blood in wastewaters.

Considering the above, two technologies for manufacture of blood-and-milk protein concentrate were developed (BMPC). This product has high nutritive properties and healing effect. The first variant of the technology is intended for laboratory conditions (variant I)[Tomov & Baychev, 1999]. Based on the results from its implementation and the additional experimental research an improved variant was developed (variant II) [Tomov *et al*., 2000; 2005].

The purpose of this work is to develop an advance technology – variant III for blood utilization in slaughterhouses.

To achieve that purpose the following tasks were solved:

- The basic technological processes, their sequence and interrelations were described;
- Optimal values of factors and parameters if technological operations were established;
- A product with higher protein, amino acids and vitamins content was obtained;
- Maximal production efficiency of the technological cycle was achieved;
- Waste minimization.

[1] *E-mail address: lvladimirov@ru.acad.bg, Tel.: +359 082 888 546*

Results and Discussion

Applied technological processes and their sequence are shown on Figure 1.

Animal blood and cow's milk, conforming to Bulgarian State Standards, are used as basic materials. These are mixed in proportions 1, 35. Obtained mixture is stirred for homogenization at rate 20 min^{-1} for 0, 24 h. Then the mixture is heated at a specified temperature/ time mode.

Calcium dichloride is used to coagulate the mixture. The coagulant in the specified proportion is added and is homogenized with the mixture. During this process a temperature of 40 ^{o}C is reached gradually and is maintained. Then the temperature is increased to 80 ^{o}C and the processing continues for 12 min. The process of coagulation is studied and optimized (Tomov *et al*., 2000).

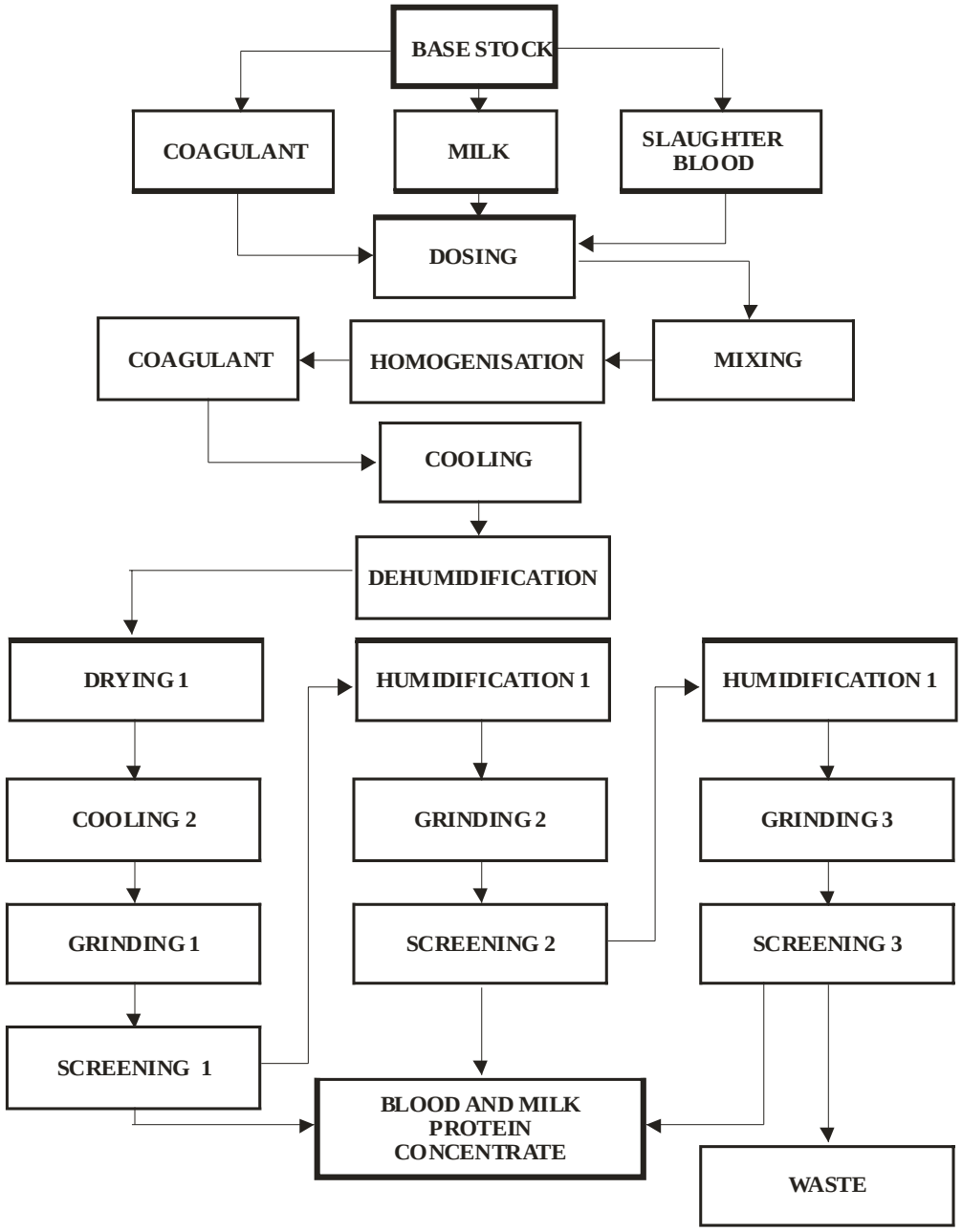

Figure 1. Basic processes and operations of the advance slaughter blood utilization technology-variant III

The coagulated material has 65-68 % relative moisture content. After cooling to 20-25 ^{o}C the material is subject to filter press dehydratation to reduce its relative moisture content to 40-42 %.

The lower moisture content of the coagulated material compared to the technology, described in (Tomov *et al*., 2000) allows improvement of the temperature mode of drying 1. Power consumption and drying time is reduced.

Temperature/time drying mode 1 is shown on Figure 2. This mode was selected in order to reduce the relative moisture content of the material to 22, 5-23 %, while keeping the amino acids and the protein content in the stock.

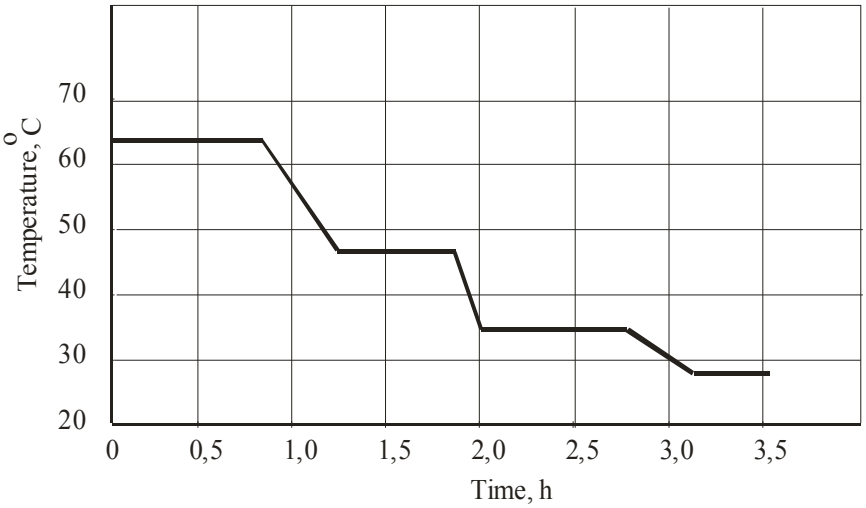

Figure 2. Temperature/ time drying mode

The material is cooled to 25-30 ^{o}C, and then it is ground in ball mill for 22 min (grinding 1 – Figure 1) and undergoes vibration screening. In this way the fine fraction with dimensions 0, 8-1, 0 mm is extracted. This fraction composes 91, 6 % of the total dried substance. Other controlled factors of grinding process are optimized and published in [Tomov *et al*., 2000].

The fraction 0.8-1.0 mm is subject to drying 2 under the temperature/ time mode, shown on Figure 2. Drying results in reduction of moisture content to 5-7 %. Carried out experimental research has proved that such moisture content guarantees one-year durability of BMPC.

Coarse fraction (with dimension above 1 mm) has 28-31 % moisture content. It undergoes three operations-humidification 1, grinding 2 and screening 2 (Figure 1). Humidification is done by means of fine water spray until 20-22 % relative moisture is obtained. Grinding in ball mill for 8 min and then screening is performed. Fine fraction is separated. Dry at room temperature. The residue is subject to the same technological operations – humidification 1, grinding 3, and screening 3.

The waste is coarse ungrindable fraction with hardness similar to that of polymer material.

BMPC is a product of full value, easy to assimilate and ecologically clean protein, used to enrich the fodder of poultry, swine and bees. It contains milk sugar, minerals, fats, vitamins A, D, E, C, B_1, B_2, B_{12}, PP, K, as well as the basic amino acids, determined by means of acid hydrolysis (Table 1).

The comparative analysis of the characteristics of the presented advance variant (variant III) of the blood utilization technology and its initial variants (variant I and II) shows:

1. Duration of the technological cycle is significantly reduced (4,8-5,7h), and productivity is increased with approximately 62,3 %;
2. Waste is reduced to the minimum of 0,12-0,23%;
3. Protein content is increased to 78,1-79,3%;

4. Mineral substances content is reduced and the fats and milk sugar content is preserved;

5. Better amino acids balance is obtained. The relative share of the basic amino acids is increased; only for leucine the value is approximately the same as in the previous variants of the technology.

6. The presented advance variant of the blood utilization technology allows obtaining of BMPC- essential component for the fodder of poultry, swine and bees.

Table 1. Comparative characteristics of slaughter blood utilization technology

№	Specifications	Unit of measure	Technology		
			Variant I (Tomov & Baychev, 1999)	Variant II (Tomov *et al*., 2000)	Variant III
1	Technological cycle duration	h	18.4-18.6	7.9-11.8	4.8-5.7
2	Productivity	kg/cycle	6.9-7.4	11.8-13.7	16.2-17.5
3	Waste	%	0.8-1.8	0.2-0.6	0.12-0.23
4	Protein	%	70.7-72.4	76.5-78.2	78.1-79.3
5	Milk sugar	%	10.2-11.2	10.8-11.5	10.6-10.9
6	Mineral substances	%	2.2-2.5	1.7-2.1	2.4-2.6
7	Fats	%	1.1-1.3	1.2-1.3	1.1-1.2
8	Aspartic acid Asp	mg/100 mg	2.432-2.845	3.445-3.78	3.612-3.714
9	Tyrosine Thr	mg/100 mg	0.885-1.008	1.072-1.211	1.147-1.637
10	Serine Ser	mg/100 mg	1.082-1.108	0.978-1.191	1.132-1.141
11	Glutamic acid Glu	mg/100 mg	2.872-2.999	2.344-2.789	2.433-2.591
12	Proline Pro	mg/100 mg	1.322-1.338	1.379-2.055	1.357-1.988
13	Glycine Gly	mg/100 mg	1.172-1.213	1.612-1.544	1.513-1.631
14	Alanine Ala	mg/100 mg	1.986-2.168	1.844-2.335	1.988-2.351
15	Valine Val	mg/100 mg	2.562-2.713	2.612-2.712	2.633-2.788
16	Methyonine Met	mg/100 mg	0.373-0.412	0.277-0.516	0.243-0.612
17	Leucine Leu	mg/100 mg	3.448-3.569	3.331-3.781	3.129-3.562
18	Phenylalain Phe	mg/100 mg	1.724-2.34	1.755-3.001	1.944-2.779
19	Histidine His	mg/100 mg	1.843-2.56	1.912-2.665	2.314-2.655
20	Lysine Lys	mg/100 mg	2.111-2.719	2.056-2.783	2.271-2.812

After consumption the mortality rate among poultry is significantly reduced and stops. Vitality, general condition, growth and muscular mass accumulation and later the laying capacity are improved. Similar effect is noticed for the physiology and general condition of pigs. The protein content is increased for bees and this product is used with great effect mainly in the process of brood cells formation.

Presented technology has significant ecological effect since the animal blood from slaughter industry is not disposed of in sewage waters and therefore it doesn't pollute water reservoirs. The implementation of this technology has proven that.

References

Tomov V, Baychev I, (1999) Technology and line for production of blood and milk concentrate under laboratory conditions, *Scientific Works of University of Russe*, **37**, 107-112.

Tomov V, Baychev I, Vladimirov L, (2000) Study of the grinding process of blood and milk protein fodder concentrate, *Notices of the Union of Scientists – Rousse*, Technical Sciences series, **3**, 96-99.

Tomov V, Baychev I, Vladimirov L, (2000) Technology of slaughter blood utilization, *Machine Mechanics*, **36**, 39-42.

Tomov V, Baychev I, Vladimirov L, (2000) Optimization of coagulation of high-protein fodder concentrate from slaughter blood, *Machine Mechanics*, **36**, 43-46.
Tomov V, Vladimirov L, (2005) Preventing water pollution by means of waste blood utilization in slaughter industry, *Ecologica*, **44**, 5-11.