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Technological Process of Germination of Wheat Grain under the Water Tincture of Aloe and ITS Physical-Chemical Properties

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Abstract*: Germination of wheat grain promotes the transition of hardly digestible nutrients into an easily accessible form with increasing the amount of vitamins and minerals. This paper presents the technological process of wheat grain germination under the water tincture of aloe. The germinating power and ability of wheat grain grown in 25% solution of water tincture of aloe are 95% and 95%, respectively. The analysis of the data shows that the amount of all nutrients decreases, since the destruction of the protein-carbohydrate complex. The activity of enzymes increases, and the cellular destruction of the endosperm occurs. Carbohydrates reduction is associated with intensive grain respiration. Germination is also associated with a decrease in fat from 2.45% to 1.25%.

***Index Terms*: rumen, treatment, alkaline, sodium hydroxide, protein loss, water-binding capacity**

I. INTRODUCTION

Wheat grain production is the largest agricultural industry and has important economic and social significance. Wheat germinated grain contains vitamins, minerals, as well as useful biological compounds [1, 2]. Germinated wheat grains are used for preventive and therapeutic purposes in diseases: metabolic disorders, weakened immunity, constipation, diarrhea and bloating [3].

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Calorie content of sprouted wheat is 198 kCal, which gives good reason to classify this product as dietary. Grain germination process changes the chemical composition of grain. Nutrients pass into an easily digestible form, the amount of vitamins, micro and macro elements is increased [4]. Germinated seeds of wheat for a short time are the basis for the production of whole grain bread. However, this product is vulnerable to accelerated microbiological damage, which limits the expansion of the use of germinated grain in the production of bakery products [5]. To accelerate the germination of wheat, various methods used, for example, bubbling, treatment with a complex composition of trace elements such as iron, copper, boron, magnesium, zinc, molybdenum, cobalt. The artificial biostimulants "Kemira Universal", "Novosil", "Humate Potassium" are also can be used [6, 7]. The goal of this paper is to develop the process of wheat germinating and study the germination power and ability of wheat grain and its chemical composition.

MATERIALS AND METHODS

Spring soft wheat “Kutulukskaya” sampled from Borodulikha region of East Kazakhstan. Botanical characteristic of grain - hybrid of Saratovskaya 29 x F1 911 (Lee x Unrra) wheat, variety of lutescens. Prismatic spike 6-11 cm long, medium density. Glume is oval, 6x9 mm in size [8]. Wheat grain was cleaned and washed. Wheat grain was soaked with boiled water for 6-8 h, the thickness of the water layer is 5-7 mm, and the water temperature was 20 °C. After soaking, the grain was washed, then put the grain in a plate, covering with gauze, so that the grain does not dry out. Aloe juice was being prepared at the same time. For this, aloe was grinded. Squeezed juice. Preparing water tincture of aloe 25 ml per 100 ml of water, the infusion time of 30 minutes which was added to the grain during germination after the last washing of the grain.

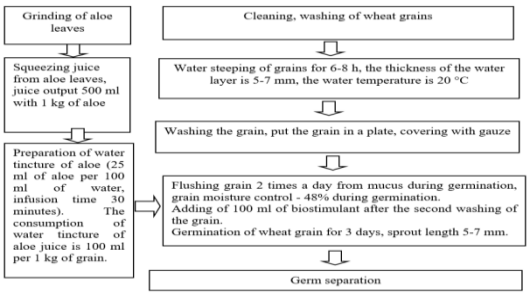


Figure 1: Technological scheme of wheat grain germination

Moisture content was determined according to National Standard GOST 9404-88 [9] by drying in electrical ovens at 130 °C for 40 min and calculating the mass difference of the samples before and after drying, according to Eq. 1:

$$W = \frac{m_1 - m_2}{m} \cdot 100,$$

where,
W - moisture content, %
m_1 – mass of weighting cup with sample before drying, g;
m_2 - mass of weighting cup with sample after drying, g;
m – mass of weighting cup, g;
100 - conversion factor to %.

II. RESULTS AND DISCUSSION

Physicochemical characteristics of wheat were determined before germination. Table 1 shows the physicochemical characteristics of Kutulukskaya wheat..

Table 1 – Physicochemical characteristics of Kutulukskaya wheat

Name of indicator	Content
Grain unit	738 g/l
Thousand-kernel weight	55 g
Grain contamination	Not detected
Grain acidity	2^0
Grain moisture	14 %
Grain clogging weed, % grain, %	 1 % 2 %
Metallomagnetic impurities content	2 mg per 1 kg
Grain gluten	32,2 %
Grain hardness	80 %

Table 2 – Chemical composition of Kutulukskaya wheat

Indicator	Content
Protein	11,8 g
Fat	2,2 g
Carbohydrate	59,5 g
Fiber	10,8 g
Water	14.0 g
Ash	1,7 g
Caloric value	305 kCal

In order to accelerate the speed of wheat germination, the plant stimulants - water tincture of aloe and water tincture of Kalanchoe as a comparative sample were used. The aloe contains vitamins A, E, C, group B, enzymes, tannins, volatile, organic acids, minerals (mg/100 g): - potassium -28.5 mg, calcium - 79.1 g, magnesium - 17.4 g, iron - 0.32 g, manganese - 0.38 μg/g, copper 1.1 μg/g, zinc 2.75 μg/g , cobalt 0.04 μg/g, chromium 0.08 μg/g, aluminum 0.09 μg/g, barium 14.9 μg/g, selenium 11.9 μg/g, nickel 0.45 μg/g, lithium 162 μg/g, boron 94 μg/g, amino acids [10]. Aloe juice has an antifungal, antimicrobial agent, promotes wound healing, improves the functioning of internal organs [11].

On the next step, the germination power and ability of wheat in water and water tincture of aloe and kalanchoe medium was determined. Germination power is the number (percentage) of grains germinated in 3 days, and germination ability is the percentage of grains germinated in 5 days. Table 3 shows the comparative indicators of germination power and ability of Kutulukskaya wheat grain.

Table 3 - Germinating power and ability of Kutulukskaya wheat grain

Indicator	Water tincture of aloe			Water tincture of kalanchoe			Water
	10 %	15 %	25 %	10 %	15 %	25 %	
Germinating power (3 days)	91 %	93 %	95 %	90 %	92 %	93 %	90%
Germinating ability (5 days)	91 %	92 %	96 %	90 %	91 %	92 %	91%

Table 4 - Wheat grain moisture changes

Holding time, h	Moisture content of grain grown in 25% of water tincture of aloe	Moisture content of grain grown in 25% of water tincture of kalanchoe	Moisture content of grain grown in water
0	14	14	14
1	38	37	35
6-8	40	39	37
12	45	44	43
24	48	48	48
48	48	48	48
72	48	48	48

An analysis of the diagram shows that when grain sprouts in 25% of water tincture of aloe, more intense moisture occurs.

In the germinated wheat grains, the chemical composition was determined. Table 4 shows the comparative chemical composition of Kutulukskaya wheat before and after germination.

Table 4 – Chemical composition of Kutulukskaya wheat grain

Indicator	Content	
	Before germinating	After germinating
Protein	11,55 g	7,41 g
Fat	2, 45 g	1,25 g
Carbohydrate	60,00 g	41, 22 g
Fiber	10,5 g	1,10 g
Water	14 g	48,1 g
Ash	1,5 g	0,92 g
Caloric value	305 kCal	198 kCal

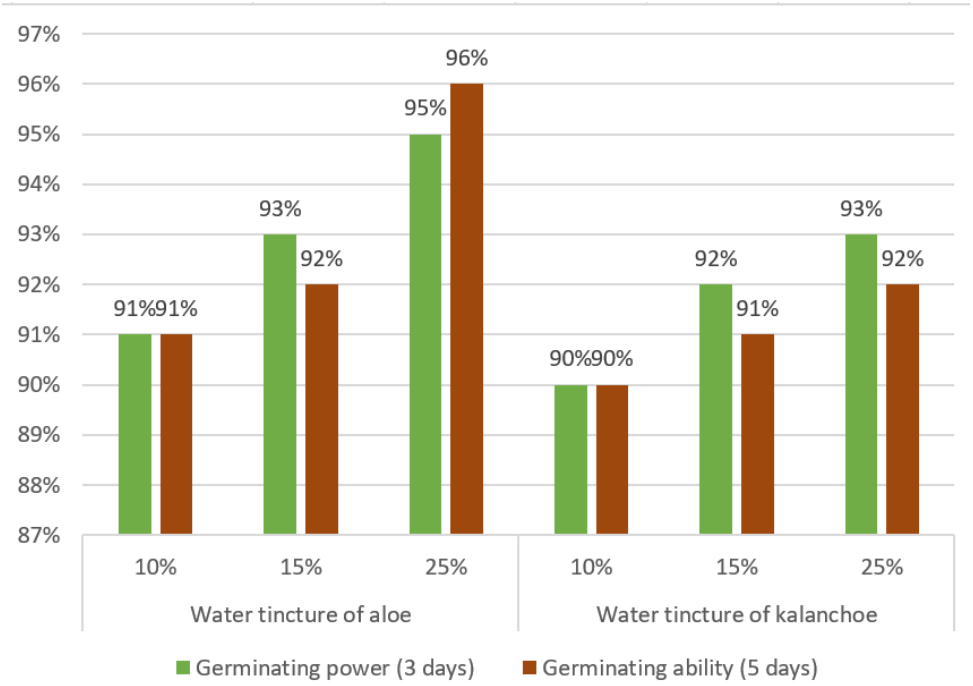
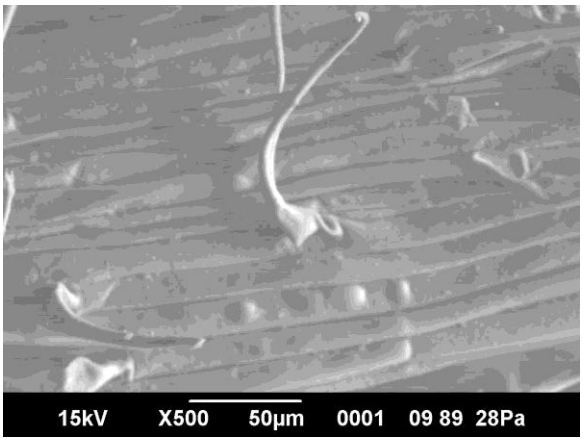
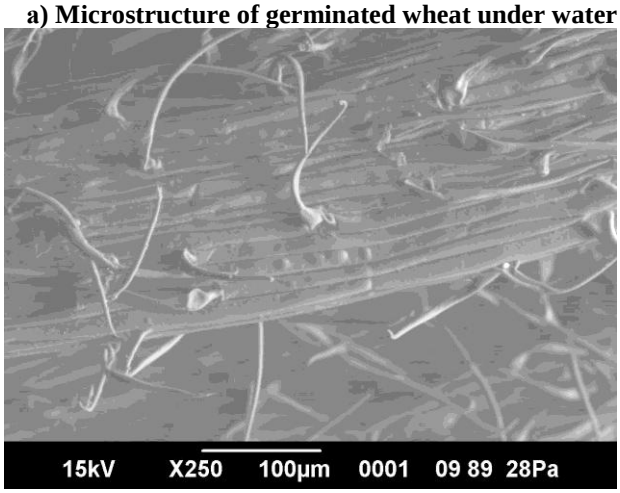


Figure 2: Germinating power and ability of Kutulukskaya wheat grain

The microstructure of germinated wheat germ was investigated. Figure 3 shows the microstructure of germinated wheat under various conditions (germination in water, germination in water tincture of Kalanchoe juice, germination in water tincture of aloe juice).

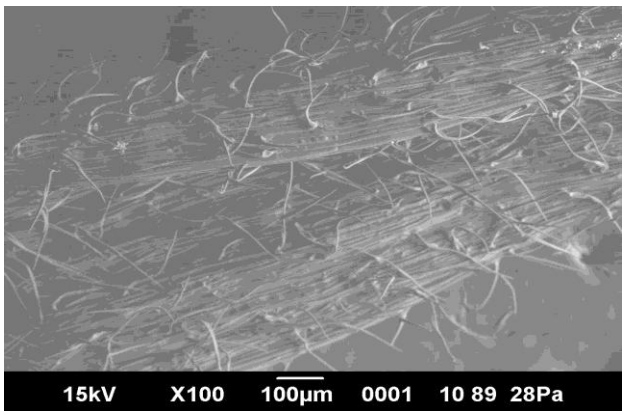


a) Microstructure of germinated wheat under water



b) Microstructure of germinated wheat under water tincture of kalanchoe

Microstructural analysis shows that germinated wheat in water tincture of aloe has a looser microstructure, and the germination process is more intense (Figure 3, c).



c) Microstructure of germinated wheat under water tincture of aloe

Figure 3: Microstructure of germinated wheat

CONCLUSION

The analysis of the data shows that the amount of all nutrients decreases, since the destruction of the protein-carbohydrate complex. The activity of enzymes increases, and the cellular destruction of the endosperm occurs. Carbohydrates reduction is associated with intensive grain respiration. Germination is also associated with a decrease in fat from 2.45% to 1.25%.

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