



Original Article

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Spirea Plus Dietary Supplement: Formulation Development and Product Quality and Safety Testing

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ABSTRACT

Good health has always been the most valuable asset as it is fundamental for survival. Various factors affect human well-being, and with our contemporary fast-paced lifestyles, the number of negative factors is increasing. Environmental hazards, physical inactivity, smoking, stress, self-medication, unhealthy eating habits are ruining our health. Recently, the attention to the importance of nutrition has intensified, as more people recognize the profound impact nutrition can make on the overall health, the quality of life, and our ability to perform everyday tasks. To help people maintain a balanced diet with a sufficient amount of vitamins, minerals, and other essential nutrients, different dietary supplements are produced. The present paper describes the dietary supplement which contains active ingredients that can effectively address metabolic disorders in lung diseases. The quality indicators, nutritional value, storage terms, and conditions are detailed. Clinical trials have been performed to evaluate the effectiveness and the functional properties of the new dietary supplement. The manufacturing process has been thoroughly examined and complies with ISO 9001, 22000, GMP to guarantee product quality and competitiveness.

Key words: *Dietary supplement, Quality indicators, Functional properties, Effectiveness*

INTRODUCTION

To address the pressing issues of social welfare, the government of the Russian Federation has introduced the National Priority Projects framework. One of the selected projects focuses on improving and maintaining public health and well-being to enhance the quality of life and sustain the number of the able-bodied population [1-8]. Therefore, the challenges of developing the proper diet and the prevention of common diseases are currently being discussed by many scientists and practitioners. New dietary supplements are developed and tested and many of them have already gained popularity due to their biologically active ingredients [9, 10]. As dietary supplements possess the required functional properties, they could provide the solution we are searching for [8, 11-17].

MATERIALS AND METHODS

The present paper discusses the raw materials, the laboratory, and production samples of the dietary supplement named Spirea Plus. The methods used included organoleptic testing, physicochemical properties testing, microbiological analysis, and sampling. The water-soluble vitamins content was determined according to the following technical standards: FR.1.31.2005.01917, MU 08-47/185, the content of fat-soluble vitamins was

evaluated using FR.1.31.2005.01810 and MU 08-47/184 technical standards. Moreover, high-performance liquid chromatography (HPLC) was employed to analyze the amount of dihydroquercetin, hesperidin, succinic acid, glycyrrhizic acid, lipoic acid, quercetin, and silibinin.

RESULTS AND DISCUSSION

A new dietary supplement to be used when dealing with lung diseases has been developed. The full list of ingredients of the Spirea Plus dietary supplement is presented in **Table 1**.

Table 1. The composition of Spirea Plus dietary supplement

No	Ingredient	1 tablet contains, mg
	'Tsifrol – 5' (antioxidant complex)	100
	<i>'Tsifrol – 5' active ingredients per 100 mg</i>	
	Superoxide dismutase	100
	Hesperidin	20.0
	Ascorbic acid	12.5
	Hibiscus (dry extract)	11.5
1	Tocopherol acetate	5.0
	Dihydroquercetin	5.0
	Beta carotene	1.75
	Coenzyme Q10	1.25
2	Licorice root (dry extract)	75
3	Badan (dry extract)	50
4	N-acetylcysteine	50
5	Succinic Acid	50
6	Edetic acid	30
7	Dandelion (dry extract)	25
8	Iron pyrophosphate	25
9	Ascorbic acid	22.5
10	Zinc citrate, trihydrate	19.3
11	Milk thistle fruit meal (dry extract)	18.75
12	Ginkgo Biloba (dry extract)	15
13	Quercetin	15
14	Glutathione	10
15	Dihydroquercetin	7.5
16	Lipoic acid	6.0
17	'Indigal-veles' (Indole - 3 - carbinol)	5.0
18	Coenzyme Q10	4.75
19	Copper asparaginate	3.12
20	Pyridoxine hydrochloride (B6)	1.0
21	Riboflavin (B2)	1.0
22	Thiamine mononitrate (B1)	0.85
23	Folic acid (B9)	0.2
24	Sodium selenite	0.08
25	Cyanocobalamin (B12)	0.0015
	Excipients: Microcrystalline cellulose, lactose, talc, Instantgam AB, croscarmellose sodium, hydroxypropyl methylcellulose, polyvinylpyrrolidone, mint nature-identical flavoring, polyethylene glycol	approx. 120
	Total	1200

The active ingredients possess the synergistic qualities that help lessen the negative influence of external toxins on the respiratory system. Plant extracts of licorice root, Badan, Ginkgo Biloba, and milk thistle can help reduce the symptoms of allergic reactions, ease respiratory infections, alleviate adverse symptoms, treat and prevent inflammation. B vitamins, minerals, and such biogenic regulators of energy metabolism as succinic acid and coenzyme Q10 increase the efficiency of oxygen uptake, help prevent hypoxia and improve breathing. The active ingredients with the vasoactive effect improve circulation in the peripheral vessels, strengthen the capillaries, and enhance gas exchange. As bioflavonoids possess antioxidant, antitoxic, and anticancer effects, they help reduce the risk of tissue damage and fight off toxins and free radicals. The antioxidant complex 'Tsifrol-5', which is used in Spirea Plus dietary supplement, enhances the positive effects of the active ingredients and reduces unwanted oxidative reactions.

The dietary supplement is manufactured in a tablet format using a multi-unit pellet technology (**Figure 1**). As the active ingredients come in pellets, this technology offers several benefits. First, it enhances the bioavailability of the active ingredients and their pharmacological properties and improves physicochemical stability. Second, due to its multiparticulate system, this technology provides the opportunity of administering incompatible ingredients without any unwanted reactions. Third, the dosage of the prescribed dietary supplement can be lowered.

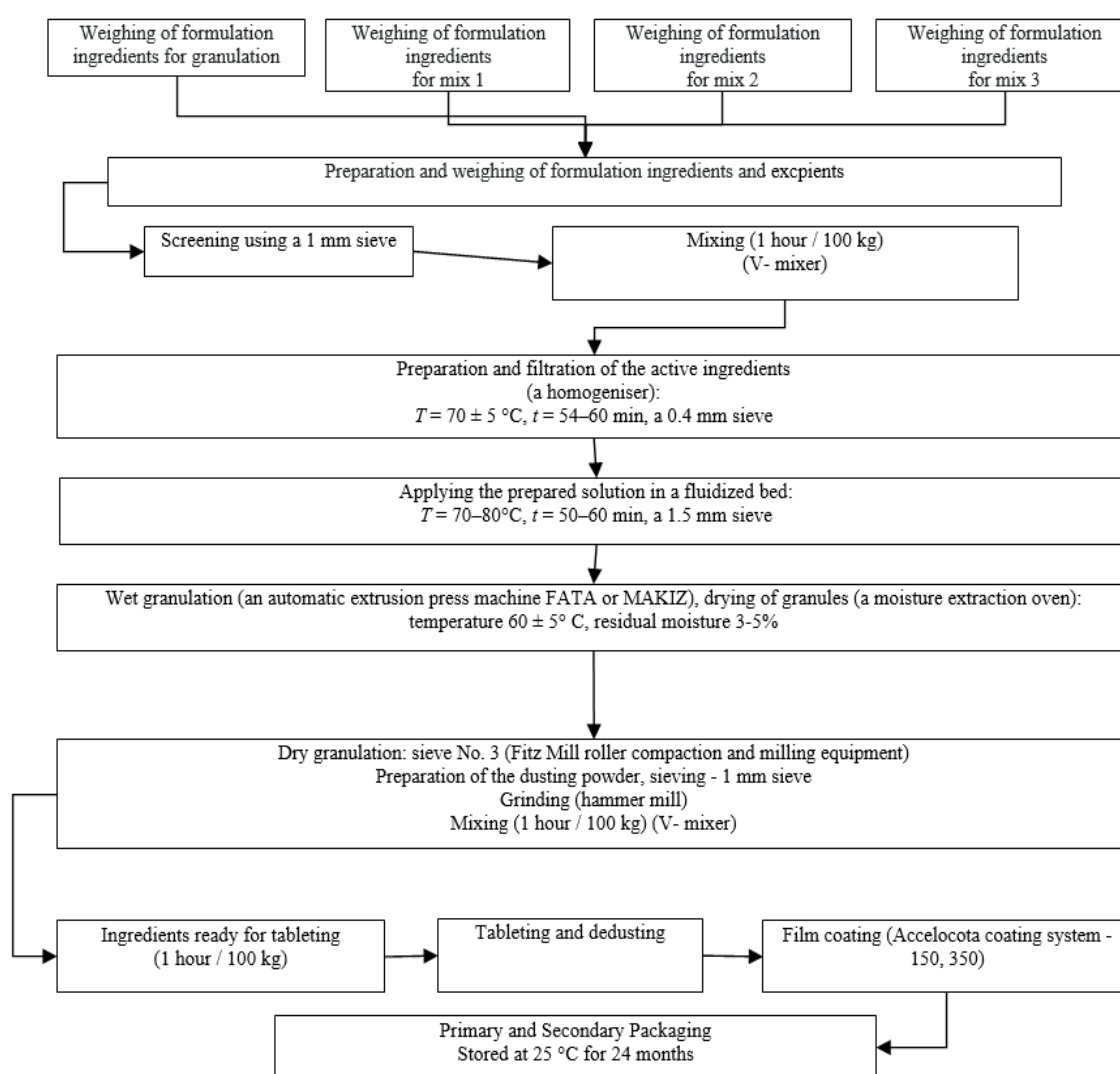


Figure 1. The manufacturing process of Spirea Plus dietary supplement.

All active ingredients are separated by a special enteric coating to control their release and absorption and maximize their bioavailability in the gastrointestinal tract. When tablets are manufactured in layers with all the active ingredients in pellets, the influence of oxygen is limited, which, along with a low moisture content of 3-5 %, prevents undesirable oxidative and hydrolytic processes and helps to control and modify the delivery and

release. Therefore, the high quality, specified nutritional value and functional properties of the dietary supplement is guaranteed.

The formulation of Spirea Plus dietary supplement was examined at the Head Testing Centre of the Institute of Nutrition, Biotechnology and Food Safety, which is the Federal State Budgetary Scientific Institution. Upon the examination, the Sanitary and Epidemiological (Hygienic) certificate of the Federal Service for Supervision of Consumer Rights Protection and Human Welfare and the Certificate of State Registration were issued. Spirea Plus dietary supplement was entered into the Federal Register of dietary supplements.

To ensure patient safety, the organoleptic, physicochemical, and microbiological indicators were studied. The stability of the dietary supplement was evaluated for 27 months following the production date under the storage conditions. To guarantee the quality and efficacy of the dietary supplement throughout its shelf life, the supplement has to be stored below 25°C. The data obtained during the testing are presented in **Tables 2 and 3**.

Table 2. The microbiological safety indicators of Spirea Plus dietary supplement.

Indicator		Indicator value	Content
KMAFanM, CFU/g, not more than		5·10 ⁴	Less than 10
Yeast and mould, CFU/g, not more than		100	Less than 10
Product weight (g), which is not allowed	E Coli	1.0	Not found
	Pathogens (Salmonella included)	10.0	Not found
	BGKP (coliforms)	0.1	Not found

Table 3. The toxicological indicators of Spirea Plus dietary supplement.

Indicator		Acceptable content level, mg / kg (for radionuclides, Bq / kg), no more than	Content
Toxic metals	Arsenic	3.0	Less than 0.01
	Cadmium	1.0	Less than 0.01
	Mercury	1.0	Less than 0.01
	Lead	5.0	0.92
Pesticides	HCH (α , β , γ -isomers)	0.1	Less than 0.002
	DDT and its metabolites	0.1	Less than 0.005
	Heptachlor	Not allowed	Less than 0.002
	Aldrin	Not allowed	Less than 0.002
Radionuclides	Cesium-137 (Bq / kg)	200	Less than 2.6
	Strontium -90 (Bq / kg)	100	Less than 66.2
	Compliance grade B	Less than 1	0.08

As can be seen from the data presented in both tables, the dietary supplement is compliant with the current health and safety regulations, and the nutritional value of the dietary supplement, as well as the recommended storage conditions, were confirmed. The data on organoleptic and physicochemical quality indicators and nutritional value of Spirea Plus dietary supplement are shown in **Tables 4 and 5** respectively.

Table 4. The organoleptic and physicochemical quality indicators of Spirea Plus dietary supplement.

Indicator	Description
Appearance	Oval tablets with pellets and clear coating
Average tablet weight	1.2 gr (1.08-1.32)
Tablet color	Beige brown with brown, blue, and yellow pellets
Content taste and smell	Distinctive
Tablet disintegration, min, not longer than	30
Tablet strength, N, not less than	90
Abrasion resistance,%, not less than	97

Table 5. The nutritional value of Spirea Plus dietary supplement (mg per 1 tablet).

Indicator	Content	% RDI
Selenium, mcg	35.0 (29.7 - 40.2)	50
Lead	6.0 (5.1 - 6.9)	40
Copper	0.6 (0.5 - 0.7)	50
Iron	4.0 (3.4 - 4.6)	35.7
Vitamin C	35.0 (29.7 - 40.2)	50
Vitamin E	5.0 (4.2 - 5.7)	50
Vitamin B ₁	0.85 (0.7 - 1.0)	56.7
Vitamin B ₂	1.0 (0.85 - 1.2)	55.6
Vitamin B ₆	1.0 (0.85 - 1.2)	50
Vitamin B ₉	0.2 (0.17 - 0.23)	100
Coenzyme Q10	6.0 (5.1 - 6.9)	20
Quercetin	15.0 (12.75 - 17.25)	50
Dihydroquercetin	12.0 (10.2 - 13.8)	50
Lipoic acid	5.0 (4.3 - 5.8)	20
Succinic acid	50.0 (42.5 - 57.5)	25
Indole-3-carbinol	5.0 (4.3 - 6.0)	10
Silibinin, not less than	14.0	47
Fructosides, not less than	80.0	-
Tannins, not less than	60	-
Glycyrrhizic acid, not less than	3.0	30

If the dietary supplement is stored below 25°C, the two-year shelf life period is guaranteed, with the supplement still safe to use three months after the expiry date.

The functional prosperities of the finished product were verified during the clinical trial. The volunteers with the chronic obstructive pulmonary disease were administered Spirea Plus dietary supplement along with the traditional therapy. The first registered marked improvement was the decrease in the severity of the shortness of breath. Those volunteers, who took two tablets per day for two weeks, demonstrated reduced sputum production. Another recorded favorable impact made by Spirea Plus dietary supplement included soothing the persistent cough the volunteers experienced upon admission. Moreover, an indirect proof of the positive influence of Spirea plus dietary supplement on the severity of the chronic obstructive pulmonary disease is the change in airway obstruction with a significant improvement in smaller bronchi.

The sputum cytology examination of the induced sputum performed during the treatment confirmed the anti-inflammatory effect of the Spirea Plus dietary supplement. The data obtained during the examination of the mucous membrane of the bronchial tree demonstrated the changes in the numbers of macrophages, neutrophils, eosinophils, and lymphocytes, which manage the inflammatory response.

CONCLUSION

The findings of the study allow us to recommend the use of Spirea Plus dietary supplements in the complex therapy and prevention of chronic obstructive pulmonary disease. Spirea Plus dietary supplement is manufactured by the scientific research-to-production facilities of Art-Life scientific production association in the city of Tomsk in full compliance with ISO 9001, 22000, GMP to guarantee the product quality and safety.

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