

РЕЗЮМЕТА НА НАУЧНИТЕ ТРУДОВЕ

НА ГЛ. АС. Д-Р АЙТЕН СОЛАК

представени за участие в конкурс за заемане на академичната длъжност „доцент” по ш. 5.

Технически науки, професионално направление 5.12. Хранителни технологии, научна специалност „Технология на биологично активните вещества (вкл. ензими, хормони, белтъчини)“ обявен от Институт по криобиология и хранителни технологии, гр. София в

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В. 4. ХАБИЛИТАЦИОНЕН ТРУД ИЛИ РАВНОСТОЙНИ НАУЧНИ ПУБЛИКАЦИИ (НЕ ПО-МАЛКО ОТ 10) В ИЗДАНИЯ, КОИТО СА РЕФЕРИРАНИ И ИНДЕКСИРАНИ В СВЕТОВНОИЗВЕСТНИ БАЗИ ДАННИ С НАУЧНА ИНФОРМАЦИЯ.

1. Dyankova, S., Bozakova, N., Boneva, V., **Solak, A.**, Ivanov, V., 2026. Formulation and characterization of hydrogel chitosan–pectin active films containing silymarin. *Molecules*, 31(2), 322. EISSN 1420-3049.

<https://www.webofscience.com/wos/woscc/full-record/WOS:001670947500001>

WEB OF SCIENCE: IF = 4.6, Q2; SCOPUS: SJR = 0.87, Q1

Abstract: Silymarin - a standardized extract from the seeds of milk thistle (*Silybum marianum* L. Gaertn.) - is mainly used for the treatment of hepatitis and other liver diseases. In recent years, the attention of researchers has been directed to its use in dermatology and wound treatment. Despite the promising results, there are still many unresolved issues in this area. The aim of the present study is to develop and characterize hydrogel chitosan–pectin films containing silymarin as an active ingredient with potential medical application. Six variants of hydrogel films (control and silymarin-loaded) were obtained from chitosan and pectin solutions by the casting method and analyzed in terms of their physicochemical, structural, mechanical and optical properties, as well as the in vitro dissolution profile of silymarin. The highest tensile strength was measured for the chitosan-based films - 23.35 ± 1.74 MPa (control) and 22.01 ± 2.67 MPa (silymarin-loaded), while the barrier properties to UV and visible light were the strongest for chitosan–pectin films with silymarin. The antioxidant potential of the films was determined by DPPH assay and it was found that the variants with silymarin have over 20 times higher antioxidant activity (from 2.020 ± 0.048 to 2.106 ± 0.190 mg TE/g) than the corresponding controls. The results showed that chitosan–pectin films with incorporated silymarin could find application as potential hydrogel dressings in the therapy of wounds and superficial burns.

2. **Solak A.**, Dimitrov N., Loginovska K. Impact of protein-phenolic interaction on the stability and bioaccessibility of phenolic compounds in extract of pomegranate peels, 2025. *BIO Web of Conferences*, 170, 01012, ISSN 2273-1709, E-ISSN 2117-4458. <https://www.scopus.com/inward/record.uri?eid=2-s2.0-105003904274&doi=10.1051%2fbioconf%2f202517001012&partnerID=40&md5=3041075a4b612d087996717addc1ffbe>

SCOPUS: SJR = 0.138, Q4

Abstract: The objective of this research is to analyze the influence of soy protein isolate (SPI) on the stability and bioaccessibility of phenolic compounds in pomegranate peel extract (ePGP) in a complexes formed between them. The complexes (SPI-ePGP) are formed in an alkaline conditions (pH 9) with pretreated protein at 90°C using different extract concentrations (1, 2 and 3%). Bioaccessibility is determined by monitoring changes in total phenolic content, flavonoids, and total monomeric anthocyanins using an in vitro digestion model. The stability of phenolic compounds is determined after treating the SPI-ePGP and the ePGP with light and heat. The results from the studies indicate substantial changes in phenolic compound levels during two of the phases of simulated digestion. High phenolic compound levels after gastric digestion go down significantly after intestinal digestion. SPI increases light and thermal stability of polyphenols in complexes. The data illustrates the impact of the protein-phenolic interaction on the stability and bioaccessibility of phenolic compounds. It also builds a theoretical foundation for developing functional foods or active materials based on soy protein isolate and extract of pomegranate peels.

3. Abarova S., Alexova R., Dragomanova S., **Solak A.**, Fagone P., Mangano K., Petralia M.C., Nicoletti F., Kalfin R., Tancheva L., 2024. Emerging therapeutic potential of polyphenols from *Geranium sanguineum* L. in viral infections, including SARS-CoV-2, *Biomolecules*, 14(1), 130, , E-ISSN 2218-273X. <https://www.webofscience.com/wos/woscc/full-record/WOS:001151895200001>

WEB OF SCIENCE: IF = 4.80, Q1; SCOPUS: SJR = 1.333, Q1

Abstract: The existing literature supports the anti-inflammatory, antioxidant, and antiviral capacities of the polyphenol extracts derived from *Geranium sanguineum* L. These extracts exhibit potential in hindering viral replication by inhibiting enzymes like DNA polymerase and reverse transcriptase. The antiviral properties of *G. sanguineum* L. seem to complement its immunomodulatory effects, contributing to infection resolution. While preclinical studies on *G. sanguineum* L. suggest its potential effectiveness against COVID-19, there is still a lack of clinical evidence. Therefore, the polyphenols extracted from this herb warrant further investigation as a potential alternative for preventing and treating COVID-19 infections.

4. **Solak A.**, Dyankova S. *Cotinus coggygria* ethanol extract as crosslinking agent in formulation of the protein films, 2024. *Journal of Chemical Technology and Metallurgy*, 59 (1), 33 – 44, ISSN

Abstract: The study explores the potential application of smoketree (*Cotinus coggygia* Scop) ethanol extract (STE) as a natural cross-linking and active component in the formulation of films based on collagen (CL), gelatin (GL) and soy protein isolate (SPI). After casting and drying of the respective film-forming solutions, elastic and homogeneous films were obtained. A significant color difference was found for all protein films with added STE compared to the control series (mainly due to an increase in yellowness). The degree of cross-linking was highest in CL_{STE} (60 %), followed by GL_{STE} (27 %) and SPI_{STE} (18 %). The antioxidant activity of the films, determined by the DPPH radical scavenging assay, increased significantly after the addition of STE. The observed increase in tensile strength (TS) for the films with STE ranged from double (CL_{STE} and SPI_{STE}) to more than 4 times (GL_{STE}). In addition, there was a significant improvement in the light barrier properties of the extract-incorporated films, but also a reduction in their transparency up to 1.5 times compared to their respective controls. No significant influence was observed on physical characteristics such as thickness, moisture absorption and total soluble matter. Research results show that STE can be successfully used as a natural cross-linking agent in protein films, resulting in improved light barrier properties as well as increased strength and antioxidant activity.

5. Tancheva L., Kalfin R., Minchev B., Uzunova D., Tasheva K., Tsvetanova E., Georgieva A., Alexandrova A., Stefanova M., **Solak A.**, Lazarova M., Hodzhev Y., Grigorova V., Yarkov D., Petkova-Kirova P., 2023. Memory recovery effect of a new bioactive innovative combination in rats with experimental dementia. *Antioxidants*, 12(12), 2050, E-ISSN 2076-3921. <https://www.webofscience.com/wos/woscc/full-record/WOS:001131990900001>

Abstract: Alzheimer's disease manifests as a complex pathological condition, with neuroinflammation, oxidative stress and cholinergic dysfunction being a few of the many pathological changes. Due to the complexity of the disease, current therapeutic strategies aim at a multitargeted approach, often relying on a combination of substances with versatile and complementary effects. In the present study, a unique combination of alpha-lipoic acid, citicoline, extracts of leaves from olive tree and green tea, vitamin D3, selenium and an immune-supporting complex was tested in scopolamine-induced dementia in rats. Using behavioral and biochemical methods, we assessed the effects of the combination on learning and memory, and elucidated the mechanisms of these effects. Our results showed that, compared to its components, the experimental combination was most efficient in improving short-and long-term memory as assessed by the step-through method as well as spatial memory as assessed by T-maze and Barnes maze underlined by decreases in AChE activity ($p < 0.05$) and LPO ($p < 0.001$), increases in SOD activity in the cortex ($p < 0.05$) and increases in catalase ($p < 0.05$) and GPx ($p < 0.01$) activities

and BDNF ($p < 0.001$) and pCREB ($p < 0.05$) levels in the hippocampus. No significant histopathological changes or blood parameter changes were detected, making the experimental combination an effective and safe candidate in a multitargeted treatment of AD.

6. Alexova R., Alexandrova S., Dragomanova S., Kalfin R., **Solak A.**, Mehan S., Petralia M.C., Fagone P., Mangano K., Nicoletti F., Tancheva, L., 2023. Anti-COVID-19 potential of ellagic acid and polyphenols of *Punica granatum* L. *Molecules*, 28(9), 3772, eISSN 1420-3049. <https://www.webofscience.com/wos/woscc/full-record/WOS:000987624500001>

WEB OF SCIENCE: IF = 4.20, Q2; SCOPUS: SJR = 0.744, Q1

Abstract: Pomegranate (*Punica granatum* L.) is a rich source of polyphenols, including ellagitannins and ellagic acid. The plant is used in traditional medicine, and its purified components can provide anti-inflammatory and antioxidant activity and support of host defenses during viral infection and recovery from disease. Current data show that pomegranate polyphenol extract and its ellagitannin components and metabolites exert their beneficial effects by controlling immune cell infiltration, regulating the cytokine secretion and reactive oxygen and nitrogen species production, and by modulating the activity of the NF κ B pathway. In vitro, pomegranate extracts and ellagitannins interact with and inhibit the infectivity of a range of viruses, including SARS-CoV-2. In silico docking studies show that ellagitannins bind to several SARS-CoV-2 and human proteins, including a number of proteases. This warrants further exploration of polyphenol-viral and polyphenol-host interactions in in vitro and in vivo studies. Pomegranate extracts, ellagitannins and ellagic acid are promising agents to target the SARS-CoV-2 virus and to restrict the host inflammatory response to viral infections, as well as to supplement the depleted host antioxidant levels during the stage of recovery from COVID-19.

7. Tancheva L., Petralia M. C., Miteva S., Dragomanova S., **Solak A.**, Kalfin R., Lazarova M., Yarkov D., Ciurleo R., Cavalli E., Bramanti A., Nicoletti F., 2020. Emerging neurological and psychobiological aspects of COVID-19 Infection, *Brain Sciences*, 10(11), 852, E-ISSN 2076-3425. <https://www.webofscience.com/wos/woscc/full-record/WOS:000593606200001>

WEB OF SCIENCE: IF = 3.394 Q3; SCOPUS: SJR = 0.921, Q3

Abstract: The SARS-CoV-2 virus, first reported in December 2019 in China, is the causative agent of the current COVID-19 pandemic that, at the time of writing (1 November 2020) has infected almost 43 million people and caused the death of more than 1 million people. The spectrum of clinical manifestations observed during COVID-19 infection varies from asymptomatic to critical life-threatening clinical conditions. Emerging evidence shows that COVID-19 affects far more organs than just the respiratory system, including the heart, kidneys, blood vessels, liver, as well as the central nervous system (CNS) and the peripheral nervous system (PNS). It is also becoming clear that the neurological and psychological disturbances that occur during the acute phase of the infection may persist well beyond the recovery. The aim of this

review is to propel further this emerging and relevant field of research related to the pathophysiology of neurological manifestation of COVID-19 infection (Neuro-COVID). We will summarize the PNS and CNS symptoms experienced by people with COVID-19 both during infection and in the recovery phase. Diagnostic and pharmacological findings in this field of study are strongly warranted to address the neurological and psychological symptoms of COVID-19.

8. Miteva D., **Solak A***, Dyankova S., Nacheva I., Dimov K., 2020. Assessment of allergenicity of irradiated dairy products in a Balb/c mice model. *Pharmacia*, 67(3), 129-133, ISSN 0428-0296. <https://www.scopus.com/inward/record.uri?eid=2-s2.0-85090779434&doi=10.3897%2fpharmacia.67.e53886&partnerID=40&md5=9d08d8efface342660dcd261a0f50eba>

SCOPUS: SJR = 0.201, Q2

Abstract: The objective of the present *in vivo* study was to analyze the changes in the immune response of the sensitized Balb/c mice against milk allergens in lyophilized cow's milk (LCM) and whey curd (LC) before and after gamma irradiation (10 kGy). The results showed lower levels of IgE in the group treated with irradiated LCM (ICM) compared to the group treated with non-irradiated LCM (NiCM). Hence, it could be suggested that gamma irradiation influenced the epitopes of the major milk proteins and was associated with lower allergenicity of the lyophilized irradiated milk. The gamma irradiation in the whey curd, however, did not significantly change the level of IgE antibodies in IC (treated with irradiated LC) compared to NiC (treated with non-irradiated LC) group.

9. Tsvetkov, T., Takeva, T., **Solak, A.**, 2006. To the Problem of Experimental Hibernation I. About the Role of Endogenous Hibernation Trigger. *Bulgarian Journal of Agricultural Science*, 12(1), 1. ISSN 1310-0351 <https://www.webofscience.com/wos/alldb/full-record/CABI:20063206808>

WEB OF SCIENCE (All Databases)

Abstract: This study was conducted to determine the factors causing hibernation in animals. 24 white mice were divided into two groups, groups I and II and were injected intraperitoneally with blood plasma of hibernating and summer active ground squirrels, respectively. It was observed that there was a rapid decrease in body temperature of group I mice, while the body temperature of group II animals did not vary. It is concluded that the factor causing hibernation is present in the blood plasma of the animals.

10. **Solak, A.** Takeva, T., Tsvetkov, T., 2005. On the structure of atretic follicles in the ovary of hibernating mammals. *Bulgarian Journal of Agricultural Science*, 11, 5, 531-537. ISSN 1310-0351. <https://www.webofscience.com/wos/alldb/full-record/CABI:20063206237>

WEB OF SCIENCE (All Databases)

Abstract: This study was conducted to determine the ovarian atretic follicles of 64 ground squirrels during the four seasons. It was observed that the female ground squirrels had seasonal sexual cycle. Their reproductive cycle started in the second week of March. The oestrus lasted for 10 days, and their pregnancy was 26-28 days. The hibernation started at the middle of September and continued until mid-March. Atretic follicles were either steroidogenic and non-steroidogenic. Steroidogenic follicles were mainly of the thecal type and nonsteroidogenic had fibrous bodies. It was observed that the follicles had two oocytes frequently, wherein one was surrounded by granulosa cells and were affected by dystrophic changes. On the other hand, the other may continue to develop and reach ovulation. This phenomenon is seen in hibernating mammals mainly in ground squirrels. Atresia is very expressed in March, April and May.

Г.7. СТАТИИ И ДОКЛАДИ, ПУБЛИКУВАНИ В НАУЧНИ ИЗДАНИЯ, РЕФЕРИРАНИ И ИНДЕКСИРАНИ В СВЕТОВНОИЗВЕСТНИ БАЗИ ДАННИ С НАУЧНА ИНФОРМАЦИЯ

1. **Solak A.**, Dimitrov N. Complexation between phenolic compounds and soy protein isolate: Effects on protein structure. *BIO Web of Conferences*, 170, 01006, 2025, ISSN 2273-1709, E-ISSN 2117-4458

<https://www.scopus.com/inward/record.uri?eid=2-s2.0-105003905232&doi=10.1051%2fbioconf%2f202517001006&partnerID=40&md5=b5d67187e22fcc08b4a2c8d1ea5d62a6>

SCOPUS: SJR = 0.138, Q4

Abstract: Complexes are formed between phenolic compounds in hydro-ethanol pomegranate peel extracts and soy protein isolate in alkaline environment (pH 9) with pre-treated protein at 90 °C. Three different extract concentrations have been used (1, 2 and 3%). The protein-phenol interaction in the complexes has been analyzed through structural, morphological and functional changes using electrophoretic (SDS-PAGE) and spectroscopic techniques (UV-Vis and FT-IR) along with scanning electron microscopy. The results indicate changes in the secondary structure of proteins and a strong affinity to bind with polyphenols. The data forms a theoretical basis for the interaction between soy protein isolate and polyphenolic compounds in extracts of pomegranate peels. It can be useful in the development of phenol-rich, soy-based functional foods and active biomaterials.

2. Ivanova, S., Miteva, D., Todorov, P., **Solak, A.**, Dimov, K., Ojakova, T., 2025. Influence of the addition from aromatic plants on the quality of milk by Bulgarian Rhodopes cattle. *Bulgarian Journal of Agricultural Science*, 31(4), 777-788. ISSN 1310-0351. <https://www.webofscience.com/wos/woscc/full-record/WOS:001565765500017>

WEB OF SCIENCE: IF = 0.5, Q4; SCOPUS: SJR = 0.183, Q3

Abstract: The purpose of the study was to determine the influence of biologically active additives in different concentrations on the organoleptic evaluation, physicochemical and fatty acid composition, antioxidant activity and total polyphenols of cow's milk for drinking, obtained from highly productive cows by Bulgarian Rhodope breed. Adding aromatic plant additives in different concentrations, improves the qualitative and quantitative composition of milk. The organoleptic evaluation of the studied milk gives us a clear idea, that the application of a higher concentration of additives worsens its smell, taste, colour, aroma and texture, but enriches it with fibers, minerals and fats, as a result of which the energy value also increases. Drinking milk with the addition of aromatic plants in dry form has a reduced content of saturated fatty acids, and was enriched with biologically active fatty acids, which in turn leads to health benefits from their consumption, and was expressed by lowering AI and TI and increasing cholesterolemic index. The antioxidant activity of milk was improved and the total content of polyphenols was increased, with the highest values, obtained when adding turmeric with black pepper.

3. Dyankova S., Doneva M., **Solak A.**, Miteva D., Nacheva I., Loginovska K., Solakov N., 2024. Physicochemical studies and electrophoretic profile of freeze-dried quail eggs. *BIO Web of Conferences*, 102, 01003, ISSN 2273-1709, E-ISSN 2117-4458.
<https://www.scopus.com/inward/record.uri?eid=2-s2.0-85191262242&doi=10.1051%2fbioconf%2f202410201003&partnerID=40&md5=b7a3b834c37c1ddcfa82e77cf3a3f111>

SCOPUS: SJR = 0.138, Q4

Abstract: The aim of the research is a comparative physicochemical and electrophoretic analysis of lyophilized egg white (albumen), egg yolk and whole egg (mélange) from quail eggs, obtained by processing at three different freezing temperatures before lyophilization. The conditions of freezing and the parameters of lyophilization, in which products with the best physicochemical properties are obtained, have been established. The protein content varies from 87.76 % (egg white) to 31.09 % (yolk), and the amount of lipids is 0.21 % and 52.94 %, respectively. All egg powders have low residual moisture – from 1.92 % to 3.49 %. The content of essential amino acids is significantly higher in the lyophilized egg white - 44.07g/100g than in the lyophilized yolk - 16.29g/100g. The results of the electrophoretic analysis (SDS–PAGE) showed a reliable match in the protein profile of the raw and freeze-dried quail eggs. Therefore, the proteins in the egg white and yolk remain unchanged after freeze-drying. This technology is a suitable approach for the utilization of unrealized quail eggs while preserving the composition, nutritional value and beneficial biological qualities. In addition to the functional advantages, freeze-dried egg powders are convenient to transport and have a significantly extended shelf life.

4. Ivanova S., Miteva D., Odzhakova T., **Solak A.**, Kostadinova E., 2024. Effect of the addition of aromatic plants on the quality of brined cow's milk cheese. *AgroLife Scientific Journal*, 13(2), 107-123, ISSN 2285-5718, eISSN 2286-0126. <https://www.webofscience.com/wos/woscc/full-record/WOS:001391256600010>

WEB OF SCIENCE: IF = 0.9 Q3; SCOPUS: SJR= 0.183, Q4

Abstract: The purpose of the study is to determine the influence of biologically active additives in different concentrations on the organoleptic evaluation, physicochemical and fatty acid composition, antioxidant activity and total polyphenols of brine cheese from cow's milk obtained from highly productive Bulgarian Rhodope cattle. The technological processing of bulk tank cow's milk to brine cheese with the addition of additives from aromatic plants in different concentrations improves their qualitative and quantitative composition. The organoleptic evaluation of the examined cheeses gives us a clear idea that the application of a higher concentration of additives worsens the smell, taste, colour, aroma and consistency. The application of the additives in different concentrations enrich the brine cheese with fibres, minerals and fats, as a result of which their energy value also increases. Cheeses with the addition of aromatic plants in dry form were characterized by a decrease in saturated fatty acids and enrichment with biologically active fatty acids, which in turn leads to health benefits from their consumption, which is expressed by a decrease in AI and TI and an increase in the cholesterolemic index.

5. **Solak A.**, Loginovska K., Dimitrov N., 2024. Protein-phenolic Interactions - influence on biological activity of polyphenolic compounds. *Journal of Mountain Agriculture on the Balkans*, 27(4), 677-690, ISSN1311-0489, E-ISSN 2367-836.

<https://www.webofscience.com/wos/alldb/full-record/CABI:20240526568>

WEB OF SCIENCE (All Databases)

Abstract: The food-health nexus is gaining increasing importance in modern societies facing global challenges related to human health due to climate change, depletion of natural resources and increased risk of new pandemics. Polyphenolic compounds have attracted the attention of the scientific community due to their high biological activity, with a potential beneficial effect on human health. Their inclusion in food can lead to a change in their functionality due to interactions with the constituent components of the food matrix. The antioxidant activity (AA) of hydro-ethanolic extract of pomegranate peel (ePGP) was analysed in this study, after complexation (at acidic, neutral and alkaline pH) with soy protein isolate (SPI). The AA was determined by the 1,1-diphenyl-2-picrylhydrazyl radical (DPPH·) scavenging capacity of SPI-ePGPs. The results show that inclusion of the ePGP increases the AA values of SPI-ePGP compared to that of the pure protein. It was found that the formation of the complexes (SPI-ePGPs) was accompanied by a decrease in free amino groups, with the lowest values observed in the alkaline-treated (pH 7.5 and 9.0) SPI-ePGPs. The obtained values for polyphenol binding are correlated with the amount of bound phenols in SPI-ePGPs and with the diafiltrated (3 kDa) free phenols. The protein denaturation inhibition assay that was carried out showed the protective effect of the SPI-ePGPs. The data on the influence of the protein macromolecule on the bioactivity of phenolic compounds in ePGP is a theoretical basis that can be used in the creation of new types of food rich in soy protein and polyphenolic compounds.

6. **Solak A.**, Dimitrov N., Loginovska K., 2024. Soy protein isolate complexes with polyphenols: physicochemical properties. *Journal of Mountain Agriculture on the Balkans*, 27(3), 527–541, ISSN 1311-0489, E-ISSN 2367-836.

<https://www.webofscience.com/wos/alldb/full-record/CABI:20240479330>

WEB OF SCIENCE (All Databases)

Abstract: This study analyses the formation of complexes between soy protein isolate (SPI) and phenolic compounds in hydro-ethanolic extract of pomegranate peel (ePGP) and the effects of protein-phenolic interaction on the structure and physicochemical properties of the protein. The complexes (SPI-ePGPs) were obtained under conditions of different pH: acidic (3.0, 4.0, 5.0), neutral (7.0) and alkaline (7.5 and 9.0), and with pre-treatment of SPI at a temperature of 90°C and 25°C. The formation of SPI-ePGPs was established by polyacrylamide gel electrophoresis in the presence of sodium dodecyl sulphate (SDS-PAGE) and UV-Vis spectroscopy. The results show that phenolic compounds change the structure of SPI, and they are most distinct in the alkali-treated SPI-ePGPs. The effect of the interaction between SPI macromolecules and phenolic compounds on protein solubility as well as foam formation and stability in SPI-ePGPs was monitored. In the complexes created, the phenolic compounds in ePGP did not increase the solubility of the protein, but had a positive effect on foaming. The research data provide a theoretical basis for creating methods for modifying soy protein and for developing new food and matrix systems for active substances in the pharmaceutical industry.

7. Dyankova S., **Solak A.** 2023. Physical, mechanical, and antioxidant properties of alginate/pectin edible films with incorporated chokeberry and wild thyme extracts. *Czech Journal of Food Sciences*, 41(5), 367-374, 2023, ISSN 1212-1800, E-ISSN 1805-9317.

<https://www.webofscience.com/wos/woscc/full-record/WOS:001091237600001>

WEB OF SCIENCE: IF = 1.20, Q4; SCOPUS: SJR = 0.349 Q3

Abstract: The purpose of the present study was to develop edible composite films based on sodium alginate and pectin with incorporated Aronia melanocarpa (Michx.) Elliot and Thymus serpyllum L. extracts. The influence of the extracts on the physicochemical, optical, mechanical, and antioxidant properties of the films was investigated. The addition of the extracts changed the colour parameters and significantly increased the barrier properties to UV and visible light. This effect is more pronounced in the film with chokeberry extract and is due to the anthocyanins contained in it (75.43 $\mu\text{g cyd eq center dot g}^{-1}$, cyd eq - cyanidin equivalents). The antioxidant activity of films with incorporated extracts was 4-fold (thyme) to 7-fold (chokeberry) higher than the control alginate/pectin film. A significant improvement in the mechanical characteristics of the films with extracts was found. The values for tensile strength were 9.41 MPa (chokeberry) and 9.54 MPa (thyme), while for the film without extract - 4.63 MPa. The resulting films could find potential application as active packaging with antioxidant properties, which could increase the quality and extend the shelf life of the foods packaged in them.

8. **Solak A.**, Dyankova S., Doneva M., Pavlova M., 2023. Edible pH sensitive polysaccharide-anthocyanin complex films for meat freshness monitoring. *BIO Web of Conferences*, 58, 01007, ISSN 2273-1709, E-ISSN 2117-4458.

<https://www.webofscience.com/wos/alldb/full-record/CABI:20230137035>

WEB OF SCIENCE (ALL DATABASES)

Abstract: One of the innovative methods for real-time determination of food freshness is the application of pH-indicator sensors, where the color change can be used for the visual detection of acidic/basic volatile compounds formed during product storage due to microbial growth. The aim of the present study is to develop a pH-responsive freshness indicator based on anthocyanins from chokeberry (*Aronia melanocarpa Elliot*) and black carrot (*Daucus carota ssp. sativus var. atrorubens Alef.*), incorporated into an alginate/pectin/arabic gum composite film. The resulting films show distinct color changes as the pH varies. The color changes from red (pH 2.0 - 3.0) through pink and pale pink (pH 4.0, 5.0 and 6.0) to purple and blue (pH 7.0 - 8.0). The most distinct is the color transition between pH 6.0 and 7.0 for the black carrot extract and the chokeberry: black carrot mixture (1:3). The applicability of the developed pH-indicator films was demonstrated in chicken meat by tracking the changes during its storage at 4°C for 7 d. The observed results show a distinct color change from pink (day 1-3) to violet and blue on day 7. The developed pH- sensitive films have potential for use in a smart packaging system as a sensor for meat freshness monitoring.

9. Dimitrov N., Dyankova S., **Solak A.**, Miteva D., Ivanova S., 2023. Study of the effect of treatment with aqueous extracts by oregano and wild basil on raw poultry meat. *BIO Web of Conferences*, 58, 01009, ISSN 2273-1709, E-ISSN 2117-4458.

<https://www.webofscience.com/wos/alldb/full-record/CABI:20230137037>

WEB OF SCIENCE (ALL DATABASES)

Abstract: The effect of treatment with aqueous antioxidant extracts of oregano (*Origanum vulgare* L.) and wild basil (*Clinopodium vulgare* L.) in refrigerated storage of raw poultry meat was studied. Physicochemical analyzes of meat samples were performed - total protein, ash, fat, dry matter, cooking loss and pH value in dynamics. The content of malondialdehyde (MDA) and the protein profile were determined. The microorganisms' growth rate in meat during storage at 4°C for a period of 14 d was monitored. After the 7thd, the total number of mesophilic microorganisms in the meat samples increased to 7.00 log cfu/g, which is indicative of decay. A significant increase in pH value was observed after 14 d of storage, but there were no significant changes in total protein content and protein profile. In all meat samples, the amounts of MDA on days 7 and 14 were significantly below the thresholds indicated in the literature. Experimental groups treated with extracts showed lower values for MDA content compared to the control, which is an indication of certain inhibition of lipid oxidation processes in meat.

10. Dyankova S., **Solak A.**, Nacheva I., Doneva M., 2022. A new type of edible food packaging based on composite biopolymer material with included chokeberry extract. *Journal of Mountain Agriculture on the Balkans*, 25, 6, 459-477, ISSN1311-0489, E-ISSN 2367-836.

<https://www.webofscience.com/wos/alldb/full-record/CABI:20230029121>

Abstract: A composite biopolymer material with potential application as food packaging has been developed. The composite material is made of sodium alginate, pectin, gelatin and gum arabic. The preparation method is based on pre-dissolving the components, mixing the solutions in a specific ratio, adding a plasticizer and homogenizing. Crosslinking with CaCl₂ solution followed by pouring and drying under controlled temperature conditions was applied. The rheological parameters of the film-forming mixtures were investigated. The determined values for dynamic viscosity are from 747 to 1030 mPa.s. Ethanol extract of chokeberry with anthocyanin content - 1.007 10.04 cyd eq mg/ml and antioxidant activity - 75.381.06 mumol TE/ml was added to the film-forming mixture in some of the samples. The resulting packaging film is homogeneous, without fragile areas, elastic, semitransparent with a cherryred nuance and has good barrier properties against light. The performed analyzes showed the preservation of the main biologically active substances from the plant extract. The antioxidant activity of the film is 15.89 0.19 mumol TE/g. The final products of the proposed technology are eco-friendly food packaging films, obtained from renewable sources. They are a good basis for the inclusion of antioxidants, which can increase the nutritional value and improve the quality of food packaged in them.

11. Miteva D., Dyankova S., Ivanova S., Doneva M., Nacheva I., **Solak A.**, Metodieva P., 2021. Study of the impact of radiation treatment upon biochemical properties of lyophilized dairy products. *Bulgarian Chemical Communications*, 53(1), 26-32, ISSN 0861-9808, E-ISSN 2534-9899.

<https://www.scopus.com/inward/record.uri?eid=2-s2.0-85103084928&doi=10.34049%2fbcc.53.1.5255&partnerID=40&md5=35ce5fe7a0ff9f175f59ba519a4a4958>

SCOPUS: SJR: 0.168, Q4

Abstract: The effect of freeze-drying and radiation treatment on the protein profile and fatty acid composition of lyophilized cow's milk and curd was studied. The results of SDS-PAGE showed that lyophilization did not alter the qualitative composition of the main proteins in milk and curd. A significant decrease in casein and whey proteins was observed after irradiation with 10 kGy. These changes in protein components are associated with a decrease in allergenicity after radiation treatment. Changes in fatty acid composition are reflected by an increase in saturated fatty acid content and a decrease in monounsaturated and polyunsaturated fatty acids. In connection with the reported experimental data it is recommended that milk and curd should be totally skimmed before radiation treatment for potential decrease of the allergenicity.

12. Pavlova M., Dyankova S., **Solak A.**, Dimitrov N., Ivanova S., 2021. Antioxidant activity of mursalski tea (*sideritis scardica* griseb.) extracts *Journal of Mountain Agriculture on the Balkans*, 24, 6, 484–500, ISSN1311-0489, E-ISSN 2367-836.

<https://www.webofscience.com/wos/alldb/full-record/CABI:20220224308>

WEB OF SCIENCE (All Databases)

Abstract: The object of the study are various extracts from the medicinal plant Mursalski (Pirin) tea. The purpose of the study is to obtain and analyse water, water-ethanol and lyophilised water extracts of the dried plant material. The dry matter content, total phenol content, total flavonoids and tannins of the three extracts were determined. For analysis of the antioxidant activity of the extracts, the radical scavenging ability was determined by DPPH method. The results are presented as Vitamin C equivalents. Of the tested extracts, the highest values for phenolic substances were found in lyophilized extract (84.802 ± 0.743 mg GAE/g), followed by water-ethanol extract (1.346 ± 0.060 mg GAE/ml). Lyophilized extracts also have the highest content of flavonoids (26.979 ± 0.632 mg QE/g) and tannins (18.840 ± 0.606 %). The results for the antioxidant activity of lyophilized and water-ethanol extracts of *Sideritis scardica* are 534.721 ± 32.340 VCEAC μ mol/g and 6.738 ± 0.821 VCEAC μ mol/ml, respectively. A statistically significant correlation was found between phenolic content and antioxidant activity in all three types of extracts.

13. Petrunov P., Miteva D., **Solak A.**, 2020. Changes in the hematological indicators in an experimental model of food allergy. *General Medicine*, 22 (5), 13 - 21, ISSN 1311-1817.

<https://www.scopus.com/inward/record.uri?eid=2-s2.0-85101837848&partnerID=40&md5=25044090d057326e7d4ff3f789506ad1>

SCOPUS: SJR = 0.111, Q4

Abstract: The aim of the presented in vivo study is to monitor the dynamics of circulating blood cells of sensitized Balb/c mice against milk allergens in lyophilized cow's milk (LCM) and lyophilized whey curd (LC) before and after gamma-ray irradiation (10 kGy). Mice from the 4 experimental groups (ICM group - receiving irradiated LCM; NiCM group - receiving non-irradiated LCM; IC group - receiving irradiated LC; NiC group - receiving non-irradiated LC) were sensitized per os using a metal probe with a dose equivalent to 1 mg milk protein (MP) per gram body weight, co-administered with cholera toxin beta protein CTB (0.02 pg/g in 200 μ l isotonic phosphate buffer PBS) five times at weekly intervals. Two control groups were used: one receiving CTB in 200 μ l PBS (CTB group) and another receiving only 200 μ l PBS (C group). After a six-week period, mice were challenged with an intraperitoneally (i.p.) administered dose of 30 mg MP/mouse in 300 μ l PBS. The results obtained show significant dynamics of erythrocytes, hemoglobin, hematocrit, platelets, neutrophils, monocytes, eosinophils and basophils in periods of sensitization (day 21) and after challenge (day 42) relative to the baseline of the first day, an hour before the first treatment with the allergen. Hematological data can be useful as non-specific markers in addition to indicators such as specific immunoglobulin (Ig) E, IgG, histamine, interleukins, etc., in the assessment of reactions to proteins on which technological approaches aimed at reducing their allergenicity have been applied.

14. **Solak, A.**, Dyankova, S., 2019. Antibacterial activity of ethanol extracts of fifteen Bulgarian plants. *Agricultural Science & Technology*, 11, 1, 74-79. ISSN 1313-8820.

<https://www.webofscience.com/wos/oldb/full-record/CABI:20193208503>

WEB OF SCIENCE (All Databases)

Abstract: Analyses were performed of the antimicrobial activity of 15 herbs and spices (lemongrass, sour cherry, horseradish, ginger, St. John's wort, common centaury, fig, clove, rose geranium, dill, rosemary, oregano, savory, smoketree and wild thyme) widely spread and used in Bulgaria and of some combinations thereof by the agar disk diffusion method. Total phenol content was the highest in the smoketree extract (43.80 ± 1.50 GAE/ml), followed by rosemary (27.80 ± 1.20 GAE/ml), clove (25.17 ± 0.26 GAE/ml), wild thyme (24.83 ± 1.20 GAE/ml), and oregano (23.50 ± 2.00 GAE/ml) extracts. It was established that ethanol extracts of many tested plants showed inhibitory action against *S. aureus* and *E. coli*. The most potent effect was observed with extracts of St. John's wort, smoketree and clove. With combination of plant extracts, very good results were demonstrated in mixtures of St. John's wort with wild thyme, with savory and with clove. The said extracts may be used as active constituents in biopolymer matrices for development of functional antimicrobial films needed for food and pharmaceutical industries.

15. **Solak, A.**, Dyankova, S., Nacheva, I., 2019. Comparative study of the physical and mechanical properties of biopolymer films from various sources. *Journal of Mountain Agriculture on the Balkans* (JMAB), 22 (3), 209-222. ISSN1311-0489.

<https://www.webofscience.com/wos/cabi/full-record/CABI:20203329800>

WEB OF SCIENCE (All Databases)

Abstract: The present study is related to the development of technology for the production of biodegradable monocomponent and two-component films based on collagen, gelatin, alginate and pectin. The obtained films have good optical and structural-mechanical characteristics. The tensile strength (TS) values measured were 3.24 MPa for collagen films and 10.54 MPa for gelatin films. The results of the test for elongation at ultimate strength (E) varied from 32.08 % to 173.4 %. For alginate films TS was 18.30 MPa and E - 78.14 %, while for pectin films the values were much lower: TS - 2.21 MPa and E - 273.3 %. In two-component films made from alginate-pectin mixtures with a ratio of 1:2; 1:1; 2:1, a significant improvement in mechanical properties was observed, with the best values in 1:1 mixtures with TS - 53.52 MPa and E - 34.4 %. The final products of the proposed technology provide a good basis for the inclusion of antimicrobial and antioxidant substances of plant origin or other natural functional ingredients and can be used as active packaging for the food industry.

16. Dyankova, S., Doneva, M. **Solak, A.**, Metodieva, P., 2018. Comparative analysis of extracts from some medicinal plants used in traditional Bulgarian medicine. *Journal of Mountain Agriculture on the Balkans* (JMAB), 21, 3, 172-183. ISSN1311-0489, E-ISSN 2367-836.

<https://www.webofscience.com/wos/alldb/full-record/CABI:20193494048>

WEB OF SCIENCE (All Databases)

The subjects of the investigation are six medicinal plants used in folk medicine in Bulgaria – dwarf everlast (*Helichrysum arenarium L.*), knotgrass (*Polygonum aviculare L.*), wild basil (*Clinopodium vulgare L.*), European mistletoe (*Viscum album L.*), field horsetail (*Equisetum arvense L.*) and common speedwell (*Veronica officinalis L.*). The traditional use of the listed herbs involves the preparation of decoctions or infusions from individual plants or mixtures thereof,

which have a variety of physiological effects – lowering of blood pressure, diuretic and choleretic effect, general strengthening of the organism, etc. The purpose of the study is to obtain water-ethanol extracts from dried plant raw materials by analyzing the influence of ethanol concentration on the extraction yield and total phenol content of the extracts. The studies were conducted at hydromodul 1:10 and three different concentrations of ethanol - 50, 60 and 70 %. The amount of extracted substances in the samples depends on the type of raw material and the ethanol concentration. Similar dependence is observed with respect to the content of total phenols. The highest values were recorded in *C. vulgare* extracted with 50% ethanol ($4,24 \pm 0,040$ mg GAE/ml) and in *V. officinalis* extract obtained with 70 % ethanol ($3,26 \pm 0,49$ GAE mg/ml).

17. Dyankova, S., Doneva, M., **Solak, A.**, Metodieva, P. 2016. Extraction and characterization of carotenoid pigments from plant sources Journal of Mountain Agriculture on the Balkans (JMAB), 19 (2), 286-299. https://rimsa.eu/images/General_Agriculture_vol_19-2_2016.pdf

WEB OF SCIENCE (All Databases)

Abstract: The discovery of numerous health problems with the use of synthetic colorants (including carcinogenicity and chronic toxicity) led to renewed interest in natural pigments derived from different sources (plants, fungi, microorganisms and animals). The aim of the study was to obtain and characterize pigment extracts rich in carotenoids from 4 plant sources – carrot, tomato, red pepper and pumpkin. Three versions of each type of raw material were tested: fresh, freeze-dried and dried in a conventional dryer. As solvents were used isopropanol, 90% acetone and heptane. The highest content of total carotenoids was obtained from dried red pepper after extraction with heptane – 246,65 mg/l, followed by freeze-dried pumpkin and carrot in isopropanol solvent, 74,50 mg/l and 35,20 mg/l respectively. In tomato variety "Bella", the highest yield was obtained from freeze-dried material and solvent 90% acetone – 21,95 mg/l. The fresh raw materials are not suitable for extraction of pigments. In general, the lyophilized samples give a higher yield, except red pepper, wherein the best results are obtained after conventional drying.

18. Takeva, T., **Solak, A.**, 2005. Morphological changes in the surface ovarian epithelial tissue of ground squirrel during the active period. *Comptes Rendus de l'Academie bulgare des Sciences*, 58(8), 989. ISSN 13101331.

<https://www.webofscience.com/wos/alldb/full-record/BCI:BCI200600005982>

WEB OF SCIENCE (All Databases)

Abstract: The surface epithelium of the ovaries of a hibernating mammal (ground squirrel) during the active period was studied. Histological, histochemical and electron microscopic methods were used. In April papillomatosis formations were observed regarded as a sign of increased cellular activity. Ultrastructural data on the presence of secretory activity of the epithelial cells of the papillomatosis formations were established.

Г.8. СТАТИИ И ДОКЛАДИ, ПУБЛИКУВАНИ В НЕРЕФЕРИРАНИ СПИСАНИЯ С НАУЧНО РЕЦЕНЗИРАНЕ ИЛИ ПУБЛИКУВАНИ В РЕДАКТИРАНИ КОЛЕКТИВНИ ТОМОВЕ

1. Иванова С., Митева Д., Димов К., Оджакова Ц., **Солак А.**, Костадинова Е., Логиновска К., Тодоров П., Сгурова А, Нинова-Николова Н. Влияние на добавката от куркума върху физикохимичния и мастнокиселинния състав на извара от краве мляко Сборник от Научната конференция с международно участие „Животновъдната наука – предизвикателства и иновации”, 1 – 3 ноември 2023, София, стр. 86-94, eISBN978-619-92591-1-5. https://www.ias.bg/conference_2023/pdf/Proceedings_2023.pdf

Резюме: Целта на проучването е да се установи влиянието на биологично активната добавка от куркума и черен пипер в съотношение 3:1 в различна концентрация върху физикохимичния и мастнокиселинния състав на извара краве мляко, получено от порода Българско Родопско говедо. Влагането на комбинацията от куркума и черен пипер под формата на суха субстанция в извара води до достоверно понижаване ($P \geq 0,01$) на добива при използване на 0,2 и 0,3% концентрация, двукратно нарастване на съдържанието на мазнини, вариране в съдържанието на белтък и пепел, двукратно понижаване на съдържанието на сол. Наситените и полиненаситените мастни киселини намаляват за сметка на нарастване на мононенаситените мастни киселини.

2. Иванова С., Митева Д., Димов К., Оджакова Ц., **Солак А.**, Костадинова Е., Логиновска К., Тодоров П., Сгурова А, Нинова-Николова Н. Влияние на добавката от куркума върху физикохимичния и мастнокиселинния състав на саламурено сирене от краве мляко. Сборник от Научната конференция с международно участие „Животновъдната наука – предизвикателства и иновации”, 1 – 3 ноември 2023, София, стр. 95-104, eISBN 978-619-92591-1-5. https://www.ias.bg/conference_2023/pdf/Proceedings_2023.pdf

Резюме: Целта на изследването е да се установи влиянието на биологично активната добавка куркума и черен пипер в съотношение 3:1 в различна концентрация върху органолептичната оценка, физикохимичния и мастнокиселинния състав на саламурено сирене от краве мляко, получено от високо продуктивни крави *порода Българско Родопско говедо*. *Органолептичната оценка на саламуреното сирене* при влагане на куркума и черен пипер, определя концентрацията от 0,1% като най- приемлива по показателите мирис, вкус,аромат, консистенция и цвят спрямо контролната група бяло саламурено сирене. Добивът на саламурено сирене нараства достоверно ($P \geq 0,001$) при влагането на 0,05% и 0,01% от добавката. Съдържанието на белтък намалява достоверно, докато на мазнините нараства. Сирената с влагане на различен процент добавка от куркума и черен пипер са добре узрели и е доказано чрез показателя степен на зрялост, които е над 16 %. Установявано е достоверно понижаване ($P \geq 0,001$) на съдържанието на наситени мастни киселини при влагането на добавката в различни концентрации за сметка на достоверно нарастване ($P \geq 0,001$) на поли и мононенаситените мастни киселини.

3. **Solak A.**, Dyankova S., Nacheva I., Doneva M., Lazova-Borisova I. Analysis of plant extracts with antibacterial effects and their application in edible alginate-pectin films. Journal of Agricultural, Food and Environmental Sciences, JAFES, 76(3), 68-75, 2022, ISSN 2545-4315. <https://doi.org/10.55302/JAFES22763>

Abstract: The existing potential risks for consumers from the synthetic antimicrobial additives and the aspiration towards reduction of the possibilities for emergence of microbial resistance reinforce the trends of searching for alternative solutions to protect foods from microbial contamination. One of these solutions is the use of natural plant antibacterial compounds. The aim of this study was to examine the antibacterial activity of extracts derived from sour cherry (*Prunus cerasus*), St. John's Wort (*Hypericum perforatum*), clove (*Syzygium aromaticum*) and smoke tree (*Cotinus coggygia*). The total content of phenols was highest in the extract from smoke tree (31.80 mg GAE / mL) and clove (23.12 mg GAE / mL). All extracts had an inhibiting effect on the tested microorganisms (*Staphylococcus aureus* ATCC 43300 and *Escherichia coli* ATCC 25922). The largest inhibition zones were observed in the extracts from St. John's Wort and smoke tree. A very good result was obtained through the combination of extracts from St. John's Wort and clove (39 mm for *Staphylococcus aureus* and 20 mm for *Escherichia coli*). The extracts from smoke tree and the combination of St. John's Wort and clove extracts preserved their high degree of antibacterial activity when they were included in edible alginate-pectin films. The films obtained in this way may be used in packaging to help reduce the microbial population on the surface of food products.

4. Ivanova S., Odjakova T., Miteva D., Kostadinova E., Todorov P., Dimov K., Loginovska K., Zgurova A., **Solak A.**, Ninova- Nikolova N. Effect of turmeric supplementation on the physicochemical composition of cow's milk and shelf life extensionConference proceedings book "Sivas international conference on scientific and innovation research", October 13-15, 2022 , p. 949- 959, IKSAD Institute and Sivas University of Science & Technology, Sivas, Türkiye, ISSUED: 24.10.2022, ISBN 978-625-8246-21-6.
https://www.iksadkongre.com/files/ugd/614b1f_690aae641b6b448d9e2539ffad4cfb28.pdf

Abstract: The purpose of the study is to determine the influence of the biologically active additive of turmeric and black pepper in a ratio of 3/1 on the physicochemical composition of cow's milk and to monitor the storage period in order to extend it. Adding the combination of turmeric and black pepper in the form of a dry substance to drinking milk resulted in an increase in total fat content at a concentration of 0.1; 0.2 and 0.3% with low confidence ($P \geq 0.05$), at the expense of protein downregulation ($P \geq 0.05$). the rest of the indicators vary within narrow limits when using the supplement at 24 hours. After 72 hours, the fat content remains higher when adding turmeric and black pepper with a concentration of 0.2 and 0.3% compared to the control milk with a high degree of reliability ($P \geq 0.001$). For the protein, significantly higher results were obtained at concentrations of 0.05 and 0.1% ($P \geq 0.05$). Lactose was unchanged from supplemented milk but decreased in control milk at 72 h compared to treated milk. Milk pH in the supplemented treated milks decreased relative to the control milk at 72 h. Storage fat, protein and lactose decreased in the control sample and were largely maintained when turmeric and black pepper supplementation was applied at different concentrations.

5. Ivanova S., Miteva D., Odjakova T., Kostadinova E., Todorov P., Dimov K., Loginovska K., Zgurova A., **Solak A.**, Ninova-Nikolova N. Effect of papermint supplementation on the physicochemical composition of cow's milk and shelf life extensionConference proceedings book "Sivas international conference on scientific and innovation research", October 13-15, 2022 , p.

960-968, IKSAD Institute and Sivas University of Science & Technology, Sivas, Türkiye,
ISSUED: 24.10.2022, ISBN 978-625-8246-21-6.
https://www.iksadkongre.com/files/ugd/614b1f_690aae641b6b448d9e2539ffad4cfb28.pdf

Abstract: The purpose of the study is to determine the influence of the biologically active peppermint supplement on the physicochemical composition of cow's milk and to monitor the storage period in order to extend it. The introduction of peppermint in the form of a dry substance in drinking milk leads to the preservation of the total fat content at the different concentrations, the density of the milk increases with the addition of a concentration of 0.1; 0.2 and 0.3% with direct 0.5% supplementation with a high level of confidence ($P \geq 0.05$), at the expense of lowering protein ($P \geq 0.001$). Protein in peppermint -supplemented milk increased slightly, while ash content increased significantly ($P \geq 0.01$) at a milk peppermint concentration of 0.1; 0.2 and 0.3% compared to drinking milk with a peppermint concentration of 0.5%. After 72 h, the obtained results for the physicochemical parameters of the unsupplemented and supplemented milk maintained their physicochemical values, but after 96 h, fat, protein, and lactose during storage decreased in the control sample and were largely maintained when peppermint supplementation was added to different concentration.

6. Ivanova S., Odjakova T., Miteva D., Kostadinova E., Todorov P., Dimov K., Loginovska K., Zgurova A., **Solak A.**, Ninova- Nikolova N. Effect of thyme supplementation on the physicochemical composition of cow's milk and shelf life extension Conference proceedings book "Sivas international conference on scientific and innovation research", October 13-15, 2022 , p. 969-976, IKSAD Institute and Sivas University of Science & Technology, Sivas, Türkiye, ISSUED: 24.10.2022, ISBN 978-625-8246-21-6.
https://www.iksadkongre.com/files/ugd/614b1f_690aae641b6b448d9e2539ffad4cfb28.pdf

Abstract: The purpose of the study is to determine the influence of the biologically active thyme supplement on the physicochemical composition of cow's milk and to monitor the storage period in order to extend it. Addition of thyme in the form of a dry substance to drinking milk leads to an increase in total fat content at different concentrations ($P \geq 0.001$) compared to control milk, the density of milk decreases significantly with the addition of thyme compared to the control group ($P \geq 0.001$), protein decreased non-significantly, ash content decreased highly significantly ($P \geq 0.001$) at all four nested concentrations. After 72 h, the obtained results for the physicochemical parameters of the milk without and with the additive maintain the trend of the original milk, but with lower values for the physicochemical parameters. Identical results were obtained after 96 h of storage.

7. Dyankova, S., A. Solak, 2018. Resorbable polymer materials for biomedical application. St. Kliment Ohridski University Press, Sofia, 68 стр. ISBN 978-954-07-4472-8.
https://www.researchgate.net/publication/327645835_Resorbable_polymer_materials_for_biomedical_application

Abstract: Bioresorbable polymer materials are being widely used in various biomedical and pharmaceutical applications. Some of bioresorbable polymers are synthetic or semisynthetic - based on polylactic and polyglycolic acids and their copolymers, polyhydroxybutyrate, polydioxanone, etc, while others have a natural origin - collagen, salts of alginic acid, chitosan and others. Their structures, functions and applications such as matrices in biomedical, pharmaceutical and food industry are discussed. Special attention is paid to collagen - widespread fibrillar protein of animal origin, with specific composition, structure, and biochemical characteristics. The use of collagen as a biomaterial has many applications: biological wound dressings, scaffold for tissue reconstruction, systems for controlled drug release, membranes for guided tissue regeneration and collagen films. Collagen products have high biocompatibility, low antigenicity, good adhesive and cohesive properties, as well as an ability for rapid hemostasis and stimulate the regenerative capacity of the body's own tissues. The water solutions, gels and suspensions of collagen have protective colloid function and a good water binding and film-forming capacity. These physico-chemical, technological and biological properties of collagen determine its various applications in the medical and pharmaceutical industries, and also as an edible, biodegradable and active food packaging.

In this review we focus on the technologies for collagen extraction from porcine skins and bovine tendons and the strategies for chemical and physico-chemical modification. The methods for obtaining purified collagen for medical bioproducts are quite similar: enzyme treatment of the raw material, acid or alkaline extraction, purification, reconstruction and crosslinking. By enzyme pre-processing, selective cleavage of telopeptides located in the nonhelical terminal regions of the collagen molecule is achieved, which not only perform intra- and intermolecular adhesion of the fibrils, but are also associated with collagen antigenicity and immunogenicity. To improve the strength and the mechanical properties of collagen biomaterials different crosslinking agents are used (aldehydes, tannins, genipin, hydrazine). Other variants of crosslinking include the addition of D-ribose, glycosaminoglycan, hyaluronic acid, chondroitin sulfate; physical methods such as dehydrothermal drying (DHT), exposure to ionizing radiation - γ -rays or electron beam; enzymatic treatment with calcium-dependent transglutaminase (Tgase) or microbial transglutaminase (mTgase). Stability, tensile strength and rate of resorption of collagen products in the body are directly dependent on the degree of cross-linking.

The experimental results on the rheological properties of collagen dispersions are presented, together with the physico-chemical and mechanical properties of collagen preparations obtained with patented technologies (own data). Examples of the production of collagen sponges and films with applications in medicine and food industry are mentioned and the impact of technological method of processing on the properties of the final product is presented.