

**Scientific report**  
(Contract number 53/01.10.2015)

**Project:** Improvement of the biochemical, rheological and technological aspects in bread making by using different composite flours

**Project number:** PN-II-RU-TE-2014-4-0214

financed by the Romanian National Authority for Scientific Research and Innovation  
CNCS – UEFISCDI

October 2015 - December 2016

**Project director: Associate Prof. Ph.D. Eng. Georgiana Gabriela CODINĂ**

**University: Ștefan cel Mare, Suceava**

The research project aim is to establish the optimal level of pulses and oilseeds flour cultivated in Romania (peas, rape, yellow and brown, tomato, pumpkin and mustard) which can substitute the wheat flour in order to obtain baking products of a high quality.

For this purpose we will investigate the physical-chemical composition of wheat flour, pulses and oilseeds that will be used in our research we will investigate from the nutritional point of view their amino acid and mineral content, we will investigate the pulses and/or oilseed-wheat flour dough behavior during the bread making process and we will evaluate the quality of the bakery products obtained.

For the period October 2015-December 2016 the research objectives proposed in Annex IV of Contract No. 53/01.10.2015 are:

1. *Research concerning the determination of the physical-chemical properties for 2 wheat flour different from the quality point of view with the following activity: moisture determination, ash, acidity, wet gluten, gluten deformation index, protein content, mineral elements, amino acids,  $\alpha$ -amylase activity;*

2. *Research concerning the determination of the physical - chemical properties of pulses and oilseeds (pea flour, rapeseed flour, yellow flaxseed flour, brown flaxseed flour, tomato seed flour, yellow mustard flour, pumpkin flour) with the following activities: protein content, lipid content, amino acid content, mineral elements, ash content, acidity, humidity;*

3. *Research concerning the determination of the physical-chemical properties of the mixed made from composite flours (pea flour, rapeseed flour, yellow flaxseed flour, brown flaxseed flour, tomato seed flour, yellow mustard flour, pumpkin flour) alone or in different combinations (humidity, acidity, protein content, lipid content, mineral content, amino acid content);*

4. *Research concerning the influence of the mix from composite flours on the dough empirical rheological properties (pea flour, rapeseed flour, golden flaxseed flour, brown flaxseed flour, tomato seed flour, yellow mustard flour, pumpkin flour) - single or in different combinations*

5. *Research concerning on the influence of the mix from composite flours (golden flaxseed flour, brown flaxseed flour, golden mustard flour, pumpkin flour) on the quality of the baking products.*

6. *Dissemination of the results obtained (Participation and publication of research results at international conferences; publication of research results in ISI indexed journals with impact factors or indexed in international databases).*

7. *Monitoring of project activities and internal evaluation of the project* (Analysis of the achievement stage of objectives; the comparison between the results obtained and predicted; checking completion of performance indicators; drafting annual report).

## **RESULTS OBTAINED**

### **1. Working methods and the devices used**

The working methods were grouped as following:

1.1. Methods used for the evaluation of the physical-chemical properties of flours from wheat, pulses and oilseeds;

1.2. Methods used for the evaluation of the dough empirical rheological properties of the mix from composite flours;

1.3. Methods used for the evaluation of the quality of the baking products obtained from the composite flours.

#### ***1.1. Methods used for the evaluation of the physical-chemical properties of flours from wheat, pulses and oilseeds***

The research concerning the determination of the physical-chemical properties for wheat flour, pulses and oilseeds (pea flour, rapeseed flour, yellow flaxseed flour, brown flaxseed flour, tomato seed flour, yellow mustard flour, pumpkin flour) and the mixed made from composite flours were made by the following methods:

- moisture content determination by oven drying, according to SR EN ISO 712:2010;
- ash content determination according to SR EN ISO 2171:2010;
- protein content determination by Kjeldahl method according to SR EN ISO 20483:2014;

- acidity determination according to SR 90:2007;
- fat content by extraction with ether through Soxhlet method;
- the mineral elements analysis was performed using an Agilent Technologies 7500 Series system coupled plasma-mass spectrometer. The spectrometric method (ICP-MS) allows the simultaneous determination of the mineral elements content after a prior acid mineralization of the sample. The following minerals were determined: *Na, Ca, Mg, Fe, Zn, Mn, Cu, Pb, Co, Cr, Ni, Se*, and *V*;

- The amino acid content of the flour samples was analyzed with a High Performance Liquid Chromatography (HPLC) (Shimadzu, Kyoto, Japan) system equipped with a LC-20 AD liquid chromatograph, SIL-20A auto samples, CTO-20AC auto sampler and a SPD-M-20A diode array detector. The separation was carried out on a 959963-902 column (Agilent Technology), with 150 mm length, 4.6 mm i.d., and 3.5  $\mu$ m-diameter particles; the detection was set at 336 nm. The oven temperature was of 40 °C. The HPLC column was 959963-902 (Agilent Technology). The following amino acids were determined: L aspartic acid, L glutamic acid, L-serine, L- histidine, L-glycine, L cysteine, L-threonine, L arginine, L alanine, L-tyrosine, L-valine, L- methionine, L-phenylalanine, L-isoleucine, L-leucine, L-lysine and L-proline.

#### ***1.2. Methods used for the evaluation of the dough empirical rheological properties of the mix from composite flours.***

The dough empirical rheological properties of the mix from the composite flours were made by using the Alveograph and Mixolab device by the following methods:

- The dough empirical rheological properties of the mix from the composite flours determined with the Mixolab device were made according to ICC standard method no. 173 (it

allows recording rheological properties during kneading, starch properties and flour enzyme activity on one test sample);

- The dough empirical rheological properties of the mix from the composite flours determined with the Alveograph device were made according to SR EN ISO 27971:2015 (characteristics analyzed: maximum pressure-P, dough extensibility-L, ratio configuration P/L, index of swelling - G, baking strength -W).

### ***1.3. Methods used for the evaluation of the quality of the baking products obtained from the composite flours.***

The quality of the baking products obtained from the composite flours were analyzed by the following methods:

- bread physical characteristics: loaf volume- by using the rapeseed displacement method, porosity and elasticity according to SR 91:2007;

- bread textural properties: hardness, cohesivity, elasticity, gumminess, chewiness by using an texture analyzer;

- bread crumb microstructure with the 20x objective of the MoticSMZ-140 stereo microscope;

- bread sensory characteristics (overall acceptability, general appearance, color, flavor, texture, taste, smell, texture) by a preference method of nine points hedonic scale.

## **2. Results and discussions**

For the research objectives proposed in Annex IV of Contract No. 53/01.10.2015 during the period October 2015-December 2016 the following results were obtained:

Objectives (Objective Name)	Associated activities	Results
O1. Research concerning the determination of the physical - chemical properties for 2 wheat flour	Determining moisture; ash; acidity; wet gluten; gluten deformation index; content of: protein, mineral elements, amino acids; $\alpha$ -amylase activity	The data about wheat flour used in this project were published in different articles (2 ISI; 2 BDI), in different conference Proceedings (2) or presented (oral or poster) at international conferences (5)
O2. Research concerning the determination of the physical - chemical properties of pulses and oilseeds	Determining moisture; ash; acidity, content of: protein, fat, mineral elements, amino acids (peas, rapeseed, yellow and brown flaxseed)	The data about different physical - chemical properties of pulses and oilseeds used in this project were published in different articles (3 ISI; 3 BDI), in different conference Proceedings (2), in requirement for patents (2) or presented (oral or poster) at International conferences (6)
	Determining moisture; ash; acidity, content of: protein, fat, mineral elements, amino acids (tomato seeds, pumpkin seeds and yellow mustard seeds)	
O3. Research concerning the determination of the physical-chemical properties of the mix obtained from composite flours (peas, rape, yellow and brown, tomato, pumpkin and mustard) single or in different combinations	Determining moisture; ash; acidity; content of: protein, fat, mineral elements, amino acids; $\alpha$ -amylase activity for one type of seed flour addition	The presentation of 2 articles (poster form and oral form) at international conferences and the requirement of 1 patent to OSIM
	Determining moisture; ash; acidity; content of: protein, fat, mineral elements, amino acids; $\alpha$ -amylase activity for different combinations of seed flour	
O4. Research concerning the influence of the mix from composite flours single or in different combinations on the dough rheological properties	Empirical rheological measurements for dough obtained with different addition levels of peas, rape, yellow and brown, tomato, pumpkin and mustard single or in different combinations	The publication of 2 ISI articles and the giving of a talk to 1 international conference (the paper was published to the proceedings and is submitted to evaluation for an ISI indexation). Also another 1 article is submitted in order to be presented at an international conference in 2017.

O5. Research concerning the influence of the mix from composite flours single on the quality of the baking products	Bakery tests, loaf volume, porosity, elasticity, bread structure obtained with different levels addition of golden and brown flaxseed, pumpkin and mustard seed	The publication of 1 article in BDI journals, the acceptance of 1 article in BDI journal, the publication of 2 articles in different conference Proceedings, the giving of a talk of 2 articles in international conference (the papers was published to the proceedings and is submitted to evaluation for an ISI indexation) and the submitted of 1 article in order to be presented at an international conference in 2017.
---	---	--

In this research project were used two white wheat flours type 650 obtained from the 2015 processing grain harvest. The wheat flours were without any additive or enzymatic corrections. The flours were of a different quality for bread making. One of the wheat flour were of a very good quality for bread making with gluten of a very good visco-elastic properties and another flour were of a strong quality for bread making with a low gluten deformation index and a resistant gluten, not extensible. Both flours presents low  $\alpha$  amylase content because the falling number values are higher than 280÷300 s [Codină G.G. et al., 2012].

The data about wheat flour used in this project (**O1**) were published or presented in different forms as following:

1. Mironeasa S., Codină G.G., 2016, *The Mixolab rheological properties and dough microstructure of deffated mustard-wheat composite flours*, Journal of Food Processing and Preservation, doi:10.1111/jfpp.13130, ISSN 0145-8892, impact factor 0.894, SRI=0.604  
Available online: <http://onlinelibrary.wiley.com/doi/10.1111/jfpp.13130/abstract>

2. Codină G.G., Mironeasa S., 2016, *Use of response surface methodology to investigate the effects of brown and golden flaxseed on wheat flour dough microstructure and rheological properties*, Journal of Food Science and Tehnology- Mysori, ISSN 0022-1155 accepted for publication, impact factor 1. 241, SRI=1.000

3. Codină G.G., Mironeasa S., Arghire C., *Physico-chemical properties of composite flour from the 650 wheat flour type and different pulses and oilseeds from Romania country*, poster presentation at The 15th International Symposium Prospects for the 3rd millennium agriculture, 29th September – 1st October, 2016, Cluj-Napoca, Romania

Available online: [http://symposium.usamvcluj.ro/images/Symposium\\_program.pdf](http://symposium.usamvcluj.ro/images/Symposium_program.pdf)  
<http://symposium.usamvcluj.ro/Book%20of%20abstract%202016.pdf>

4. Codină G.G., Mironeasa S., Todosi-Sănduleac E., *Studies regarding the influence of brown flaxseed flour addition in wheat flour of a very good quality for bread making on bread quality*, oral presentation at The 15th International Symposium Prospects for the 3rd millennium agriculture, 29th September - 1st October, 2016, Cluj-Napoca, Romania, accepted for publication in Bulletin of University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca. Food science and technology, ISSN 2344-2344.

Available online: [http://symposium.usamvcluj.ro/images/Symposium\\_program.pdf](http://symposium.usamvcluj.ro/images/Symposium_program.pdf)  
<http://symposium.usamvcluj.ro/Book%20of%20abstract%202016.pdf>

5. Mironeasa S., Codină G.G., Oroian M., *Bread quality characteristics as influenced by the addition of tomato seed flour*, oral presentation at The 15th International Symposium Prospects for the 3rd millennium agriculture, 29th September - 1st October, 2016, Cluj-Napoca, Romania, accepted for publication in Bulletin of University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca. Food science and technology, ISSN 2344-2344.

Available online: [http://symposium.usamvcluj.ro/images/Symposium\\_program.pdf](http://symposium.usamvcluj.ro/images/Symposium_program.pdf)  
<http://symposium.usamvcluj.ro/Book%20of%20abstract%202016.pdf>

6. Codină G.G., Mironeasa S., Gutt G., Todosi-Sănduleac E., 2016, *Influence of the golden flaxseed addition on bread quality of wheat flour with a very good quality for bread*

making, oral presentation at the International Conference Modern technologies in the food industry, 20th October - 22th October, 2016, Chişinău, published in Conference Proceeding, p. 151-157, ISBN 978-9975-87-138-9.

7. Mironeasa S., Codină G.G., Mironeasa C., 2016, *Effects of the pumpkin seed addition on bread quality of wheat flour with a very good quality for bread making*, oral presentation at the International Conference Modern technologies in the food industry, 20th October - 22th October, 2016, Chişinău, published in Conference Proceeding, p. 229-237, ISBN 978-9975-87-138-9.

8. Mironeasa S., Codină G.G., *Evaluation the effects of pumpkin seed flour addition in wheat flour of a strong quality for bread making on bread quality*, SGEM International Conferences Vienna Green, 2th November - 5th November, 2016, Vienna, Austria, oral presentation published in the Conference Proceeding (Book 6 Nano, Bio and Green-Technologies for a sustainable Future, vol. III) pp. 261-269, submitted for evaluation and indexation in the scientific databases – ISI Web of Sciences, Thomson Reuters, Scopus, Elsevier products, Ebsco, ProQuest, Mendeley, British Library, etc.

Available online programme conference:

<http://www.sgemviennagreen.org/index.php/sgemviennagreen-deadlines/conference-agenda-menu>

9. Codină G.G., Mironeasa S., Mironeasa C., *The alveograph rheological properties and bread quality of composite defatted mustard - wheat flour*, SGEM International Conferences Vienna Green, 2th November - 5th November, 2016, Vienna, Austria, oral presentation published in the Conference Proceeding (Book 6 Nano, Bio and Green-Technologies for a sustainable Future, vol. III) pp. 355-363, submitted for evaluation and indexation in the scientific databases – ISI Web of Sciences, Thomson Reuters, Scopus, Elsevier products, Ebsco, ProQuest, Mendeley, British Library, etc.

Available online programme conference:

<http://www.sgemviennagreen.org/index.php/sgemviennagreen-deadlines/conference-agenda-menu>

Some data about different physical - chemical properties of pulses and oilseeds used in this project (**O2**) were published in different forms as following:

1. Mironeasa S., Codină G.G., Stroe S., 2016, *A new simple method for the evaluation of mineral elements in different oilseeds*, Communications in Soil Science and Plant Analysis, 47 (15): 1731-1737, ISSN 0010-3624, impact factor 0.529, SRI=0.578

Available online: <http://dx.doi.org/10.1080/00103624.2016.1206914>

2. Mironeasa S., Codină G.G., 2016, *The Mixolab rheological properties and dough microstructure of deffated mustard-wheat composite flours*, Journal of Food Processing and Preservation, doi:10.1111/jfpp.13130, ISSN 0145-8892, impact factor 0.894, SRI=0.604

Available online: <http://onlinelibrary.wiley.com/doi/10.1111/jfpp.13130/abstract>

3. Codină G.G., Mironeasa S., 2016, *Use of response surface methodology to investigate the effects of brown and golden flaxseed on wheat flour dough microstructure and rheological properties*, Journal of Food Science and Tehnology- Mysori, ISSN 0022-1155 accepted for publication, impact factor 1.241, SRI=1.000

5. Codină G.G., Mironeasa S., 2016, *Application of D-Optimal Mixture Design to optimize the wheat-pumpkin composite flour for bread production*, Food and Environment Safety, 15 (1): 10-20

Available online: <http://www.fia.usv.ro/fiajournal/>

6. Codină G.G., Mironeasa S., Arghire C., *Physico-chemical properties of composite flour from the 650 wheat flour type and different pulses and oilseeds from Romania country*, poster presentation at The 15th International Symposium Prospects for the 3rd millennium agriculture, 29th September – 1st October, 2016, Cluj-Napoca, Romania

Available online: [http://symposium.usamvcluj.ro/images/Symposium\\_program.pdf](http://symposium.usamvcluj.ro/images/Symposium_program.pdf)  
<http://symposium.usamvcluj.ro/Book%20of%20abstract%202016.pdf>

7. Mironeasa S., Codină G.G., Mironeasa C., *Minerals contents of some pulses and oilseeds*, poster presentation at The 15th International Symposium Prospects for the 3rd millennium agriculture, 29th September – 1st October, 2016, Cluj-Napoca, Romania

Available online: [http://symposium.usamvcluj.ro/images/Symposium\\_program.pdf](http://symposium.usamvcluj.ro/images/Symposium_program.pdf)  
<http://symposium.usamvcluj.ro/Book%20of%20abstract%202016.pdf>

8. Codină G.G., Mironeasa S., Todosi-Sănduleac E., *Studies regarding the influence of brown flaxseed flour addition in wheat flour of a very good quality for bread making on bread quality*, oral presentation at The 15th International Symposium Prospects for the 3rd millennium agriculture, 29th September - 1st October, 2016, Cluj-Napoca, Romania, accepted for publication in Bulletin of University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca. Food science and technology, ISSN 2344-2344.

Available online: [http://symposium.usamvcluj.ro/images/Symposium\\_program.pdf](http://symposium.usamvcluj.ro/images/Symposium_program.pdf)  
<http://symposium.usamvcluj.ro/Book%20of%20abstract%202016.pdf>

9. Mironeasa S., Codină G.G., Oroian M., *Bread quality characteristics as influenced by the addition of tomato seed flour*, oral presentation at The 15th International Symposium Prospects for the 3rd millennium agriculture, 29th September - 1st October, 2016, Cluj-Napoca, Romania, accepted for publication in Bulletin of University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca. Food science and technology, ISSN 2344-2344.

Available online: [http://symposium.usamvcluj.ro/images/Symposium\\_program.pdf](http://symposium.usamvcluj.ro/images/Symposium_program.pdf)  
<http://symposium.usamvcluj.ro/Book%20of%20abstract%202016.pdf>

10. Codină G.G., Mironeasa S., Gutt G., Todosi-Sănduleac E., 2016, *Influence of the golden flaxseed addition on bread quality of wheat flour with a very good quality for bread making*, oral presentation at the International Conference Modern technologies in the food industry, 20th October - 22th October, 2016, Chişinău, published in Conference Proceeding, p. 151-157, ISBN 978-9975-87-138-9.

11. Mironeasa S., Codină G.G., Mironeasa C., 2016, *Effects of the pumpkin seed addition on bread quality of wheat flour with a very good quality for bread making*, oral presentation at the International Conference Modern technologies in the food industry, 20th October - 22th October, 2016, Chişinău, published in Conference Proceeding, p. 229-237, ISBN 978-9975-87-138-9.

12. Mironeasa S., Codină G.G., *Evaluation the effects of pumpkin seed flour addition in wheat flour of a strong quality for bread making on bread quality*, SGEM International Conferences Vienna Green, 2th November - 5th November, 2016, Vienna, Austria, accepted for oral presentation and will be published in the Conference Proceeding, submitted for evaluation and indexation in the scientific databases – ISI Web of Sciences, Thomson Reuters, Scopus, Elsevier products, Ebsco, ProQuest, Mendeley, British Library, etc.

Available online programme conference:

<http://www.sgemviennagreen.org/index.php/sgemviennagreen-deadlines/conference-agenda-menu>

13. Codină G.G., Mironeasa S., Mironeasa C., *The alveograph rheological properties and bread quality of composite defatted mustard - wheat flour*, SGEM International Conferences Vienna Green, 2th November - 5th November, 2016, Vienna, Austria, oral presentation published in the Conference Proceeding (Book 6 Nano, Bio and Green-Technologies for a sustainable Future, vol. III) pp. 355-363, submitted for evaluation and indexation in the scientific databases – ISI Web of Sciences, Thomson Reuters, Scopus, Elsevier products, Ebsco, ProQuest, Mendeley, British Library, etc.

Available online programme conference:

<http://www.sgemviennagreen.org/index.php/sgemviennagreen-deadlines/conference-agenda-menu>

As a conclusion regarding the research obtained at the objectives **O2** and **O1** our results indicated the fact that for the all oilseeds, pulses and wheat flour evaluated was obtained the lowest value for moisture content for the yellow flaxseed flour and pumpkin seed flour, the lowest value for ash content were obtained for pea flour and brown flaxseed flour and the lowest value for acidity were obtained for the yellow and brown flaxseed flour. From the point of view of the mineral content analyzed by ICP-MS sodium is the best element represented in all types of flours. The tomato seed flour presents the highest amount of magnesium, chrome, manganese, iron, copper, zinc compared to the rest of flours types analyzed. The yellow flaxseed flour presents the highest amount of calcium and sodium compared to the rest of flours types analyzed. Compared to the wheat flours samples analyzed all the pulses and oilseeds samples presented with few exceptions higher values for the elements analyzed. Lead, a metal with a toxic character was presented only in low amounts in mustard seed flour. The highest protein content was recorded for the mustard seed and the lowest value for the brown flaxseed. From the lipid point of view the lowest value were recorded for the pea flour and the highest value for the rape seed flour.

In the publications mentioned above regarding the objective **O2** and **O1** from our research project no data has been published about the amino acid content of the oilseeds, pulses and wheat flour analyzed. Due to the fact that we wanted to publish the results obtained we cannot detail very much the results obtained and we will communicate only few summary data. According to the data obtained for the amino acid point of view lower values were obtained for L methionine (between 117.60 and 129.36 mg/100g), L alanine (between 136.02 and 149.63 mg/100g), L histidine (between 151.90 and 167.09 mg/100g), L cysteine (between 160.72 and 176.79 mg/100g), L lysine (between 186.20 and 204.82 mg/) and high values for L glutamic acid (between 1891.40 and 2080.54 mg/100g), L proline (between 655.62 and 721.18 mg/100g) and L aspartic acid (between 361.62 and 397.78 mg/100g).

Regarding the research objective **O3** the data obtained were published or presented in different forms as following:

1. Codină G.G., Mironeasa S., Arghire C., *Physico-chemical properties of composite flour from the 650 wheat flour type and different pulses and oilseeds from Romania country*, poster presentation at The 15th International Symposium Prospects for the 3rd millennium agriculture, 29th September – 1st October, 2016, Cluj-Napoca, Romania

Available online: [http://symposium.usamvcluj.ro/images/Symposium\\_program.pdf](http://symposium.usamvcluj.ro/images/Symposium_program.pdf)

<http://symposium.usamvcluj.ro/Book%20of%20abstract%202016.pdf>

2. Mironeasa S., Codină G.G., *Evaluation the effects of pumpkin seed flour addition in wheat flour of a strong quality for bread making on bread quality*, SGEM International Conferences Vienna Green, 2th November - 5th November, 2016, Vienna, Austria, oral presentation published in the Conference Proceeding (Book 6 Nano, Bio and Green-Technologies for a sustainable Future, vol. III) pp. 261-269, submitted for evaluation and indexation in the scientific databases – ISI Web of Sciences, Thomson Reuters, Scopus, Elsevier products, Ebsco, ProQuest, Mendeley, British Library, etc.

Available online programme conference:

<http://www.sgemviennagreen.org/index.php/sgemviennagreen-deadlines/conference-agenda-menu>

3. Mironeasa S., Codină G.G., 2016, *Mix din făină de grâu tip 650 și făină din semințe oleaginoase*, requirement for patent, registered at OSIM with no. A/00668 in the 21.09.2016

For the research objective **O4** were published the following articles:

For the *mustard flour addition in wheat flour*:

1. Mironeasa S., Codină G.G., 2016, *The Mixolab rheological properties and dough microstructure of defatted mustard-wheat composite flours*, Journal of Food Processing and Preservation, doi:10.1111/jfpp.13130, ISSN 0145-8892, impact factor 0.894, SRI=0.604 Available online: <http://onlinelibrary.wiley.com/doi/10.1111/jfpp.13130/abstract>

2. Codină G.G., Mironeasa S., Mironeasa C., *The alveograph rheological properties and bread quality of composite defatted mustard - wheat flour*, SGEM International Conferences Vienna Green, 2th November - 5th November, 2016, Vienna, Austria, oral presentation published in the Conference Proceeding (Book 6 Nano, Bio and Green-Technologies for a sustainable Future, vol. III) pp. 355-363, submitted for evaluation and indexation in the scientific databases – ISI Web of Sciences, Thomson Reuters, Scopus, Elsevier products, Ebsco, ProQuest, Mendeley, British Library, etc.

Available online programme conference:

<http://www.sgemviennagreen.org/index.php/sgemviennagreen-deadlines/conference-agenda-menu>

For the **flaxseed flour (brown and golden variety) addition in wheat flour**:

1. Codină G.G., Mironeasa S., 2016, *Use of response surface methodology to investigate the effects of brown and golden flaxseed on wheat flour dough microstructure and rheological properties*, Journal of Food Science and Tehnology- Mysori, ISSN 0022-1155 accepted for publication, impact factor 1.241, SRI=1.000

The screenshot shows the Editorial Manager interface for the Journal of Food Science and Technology. It displays a table of submissions with the following columns: Action, Manuscript Number, Title, Initial Date Submitted, Status Date, Current Status, Date Final Disposition Set, and Final Disposition. The table contains one entry for a submission by Silvia Mironeasa, Ph.D., with manuscript number JFST-D-16-00075. The submission title is 'USE OF RESPONSE SURFACE METHODOLOGY TO INVESTIGATE THE EFFECTS OF BROWN AND GOLDEN FLAXSEED ON WHEAT FLOUR DOUGH MICROSTRUCTURE AND RHEOLOGICAL PROPERTIES'. The initial date submitted is 01 Apr 2016, the status date is 20 Oct 2016, the current status is 'Completed Accept', the date final disposition set is 20 Oct 2016, and the final disposition is 'Accept'.

Action	Manuscript Number	Title	Initial Date Submitted	Status Date	Current Status	Date Final Disposition Set	Final Disposition
<a href="#">Action Links</a>	JFST-D-16-00075	USE OF RESPONSE SURFACE METHODOLOGY TO INVESTIGATE THE EFFECTS OF BROWN AND GOLDEN FLAXSEED ON WHEAT FLOUR DOUGH MICROSTRUCTURE AND RHEOLOGICAL PROPERTIES	01 Apr 2016	20 Oct 2016	Completed Accept	20 Oct 2016	Accept

2. Codină G.G., Mironeasa S., 2017, *Bread quality and Alveograph rheological properties of composite flour made from flaxseed and wheat of 650 type of a strong quality for bread making* submitted in order to be presented and published to the conference proceeding at the 4th International Conference on Food Security and Nutrition (ICFSN 2017) that will be held in Prague, Czech Republic during March 13-15, 2017 (<http://www.icfsn.org/>)

ICFSN <icfsn@cbees.net>  
 To: Georgiana Codina  
 Nov 28 at 5:02 AM

Dear Codina,

Thanks for your submission paper "Bread quality and Alveograph rheological properties of composite flour made from flaxseed and wheat of 650 type of a strong quality for bread making" to ICFSN 2017. Your paper looks nicely prepared and has already passed the preliminary review of the conference committee, which will then enter the further peer review process performed by international reviewers in related fields. And you'll be informed of the review result by the notification date Dec 25, 2016.

By the way, your paper is given the paper ID: S2013. Keep your paper ID in mind and feel free to contact me should you have any query about your paper any time.

Yours faithfully,  
 --  
 If you need more information about the conference, please visit our website <http://www.icfsn.org/>.  
 Lydia Iiu  
 Conference Specialist  
 ICFSN 2017  
 APCBEE

Regarding the effect of peas, rape, tomato and pumpkin flour on dough empirical rheological measurements no data has been published yet. Due to the fact that we want to publish the results obtained (together with the results that we want to achieve in the 2017 year according to this year activities - dough microstructure evaluation, dough fundamental



rheological properties) we cannot detail very much the results obtained and we will communicate only few summary data obtained.

For the ***tomato seed flour addition in wheat flour:***

Regrading the data obtained at the *Mixolab device* for the two wheat flour of a different quality for bread making it was noticed an increase of stability up to 10% tomato seed addition and then a decrease probably due to the gluten dilution. Regarding the C2 torque were not noticed significant changes with the increase level of tomato seed addition. Higher levels of tomato seed flour addition in wheat flour lead to a lower value for C3 torque indicating the fact that tomato seed is inhibiting the starch gelatinization process delaying the swelling of the starch granules. The lowest C4 torque were obtained for at level of 20% tomato seed addition probably due to a decrease of available water for the starch granules. The C5 torque decreased with the increase level of tomato seed addition indicating a low retrogradation and recrystallization.

Regarding the *Alveograph data values* the dough tenacity (P) decreases up to 15% tomato seed addition and then slightly increases. Dough extensibility (L) and index of swelling (G) decreases direct proportional with tomato seed addition presenting very low values at a levels of 20% tomato seed addition (L=24 mm for the strong flour). Also baking strength (W) decreases up to  $133 \cdot 10^{-4} \text{J}$  for the level of 20% tomato seed addition in wheat flour of a good quality for bread making.

For the ***pumpkin seed flour addition in wheat flour:***

At the *Mixolab device* we obtained an increase of dough stability up to 10% pumpkin seed flour addition for both types of wheat flour different from the quality point of view. The C2 torque values decreases by pumpkin seed addition probably due to a lower water availability in the dough system. The C3 torque value decreases up to 1.16 N·m for 20% pumpkin seed addition for the wheat flour of a good quality for bread making probably due to the pumpkin high content in lipids in the dough system, which may form some complexes with protein and starch preventing the leaching of amylase from the dough complex. The C4 torque decreases up to 10% pumpkin seed addition and then slightly increases probably due to the high lipid content from pumpkin seed. The lowest value for the difference between C5 torque and C4 torque were obtained at 20% pumpkin seed addition indicating the fact that pumpkin seeds addition limits starch retrogradation and preserves the bread freshness.

The *Alveograph data values* indicates the fact that the pumpkin seed addition reduces dough extensibility (G and L value decreases) dough tenacity up to 59 mm (the lowest value obtained) for wheat flour of a good quality for bread making with 20% pumpkin seed addition and dough baking strength.

For the ***rape seed flour addition in wheat flour:***

For the rape seed addition dough stability obtained at the *Mixolab device* decreases up to 2.62 min for the wheat flour of a good quality for bread making at a level of 20% rape seed addition. The C2 torque values decreases by rape seed addition probably due to the gluten dilution. The lower maximum consistency during stage 3 (C3 torque) were recorded for 20% rape seed flour added (1.19 N·m for 20% rape seed addition for the wheat flour of a good quality for bread making). The C4 value slightly decreases more for the wheat flour of a strong quality for bread making than for the wheat flour of a good quality for bread making. The C5 torque value (a parameter associated with the recrystallization of the starch) decreases with the increase level of rape seed flour addition.

Regarding the *Alveograph data* we noticed an increase of dough tenacity the lowest value being 50 mm for dough with 20% rape seed flour addition in wheat flour for a good quality for bread making. Also dough extensibility and baking strength significantly decreases with the increase level of rape seed addition.

For the ***pea seed flour addition in wheat flour:***

The Mixolab parameters has been significantly changed by pea seed flour addition. Dough stability decreases up to 4.10 min for dough with 20% pea sees flour addition in wheat flour of a good quality for bread making. The C2 torque decreases with the increase level of pea flour addition probaly due to the pea seed flour interference with the protein unfolding. The C3 torque value slightly decreases (it does not present significant changes between 5÷15% pea seed flour addition) no matter the quality of wheat flour is. The difference between C5 torque and C4 torque decreases with the increase level of pea seed flour addition indicating the fact that pea seed flour will not produce a delay of starch retrogradation.

Regarding the *Alveograh data* we obtained some results only for 10% pea seed flour addition for wheat flour of a good quality for bread making and for 5% pea flour addition for wheat flour of a strong quality for bread making. The dough with pea seed flour were difficult to be obtain, resitant dough tenacity significant increasing from 121 to 192 mm for wheat flour of a strong quality for bread making. Aslo dough extensibility, index of swelling and baking strength decreases by pea seed flour addition.

For the research objective **O5** all the activities mentioned (bakery tests, loaf volume, porosity, elasticity, bread structure obtained with different levels addition of golden and brown flaxseed, pumpkin and mustard seed) were published in the following articles:

For the **golden flaxseed flour addition in wheat flour**:

1. Codină G.G., Mironeasa S., Gutt G., Todosi-Sănduleac E., 2016, *Influence of the golden flaxseed addition on bread quality of wheat flour with a very good quality for bread making*, oral presentation at the International Conference Modern technologies in the food industry, 20th October - 22th October, 2016, Chişinău, published in Conference Proceeding, p. 151-157, ISBN 978-9975-87-138-9.

**INFLUENCE OF THE GOLDEN FLAXSEED ADDITION ON BREAD QUALITY OF WHEAT FLOUR WITH A VERY GOOD QUALITY FOR BREAD MAKING**

**Codină G. G.<sup>1</sup>, Mironeasa S.<sup>1</sup>, Gutt G.<sup>1</sup>, Todosi-Sănduleac E.<sup>1</sup>**

<sup>1</sup>Stefan cel Mare University of Suceava, Suceava, Romania

Georgiana Gabriela Codină: codinageorgiana@yahoo.com, codina@fia.usv.ro

**Abstract:** The aim of this study was to analyze the effect of golden flaxseed addition in different doses (5%, 10%, 15%, 20%) in wheat flour 650 type with a very good quality for bread making in order to improve bread quality. It was analyzed bread physical (loaf volume, porosity, elasticity), textural (hardness, cohesiveness, adhesiveness, viscosity, elasticity, gumminess, chewiness), color profile (*L*, *a*, *b*,  $\Delta L$ ,  $\Delta a$ ,  $\Delta b$ ,  $\Delta E$ ), sensorial (for overall acceptability, appearance, color, flavor, texture, taste, smell, texture) and microstructure. The best results were obtained for the bread with 10-15% golden flaxseed flour addition.

**Key words:** wheat flour, golden flaxseed, bread, textural, microstructure

**Introduction**

Flax (*Linum usitatissimum*) is an important oilseed crop industrial used in especially for it oil content (30÷40%) [Oomah B.D., 2001]. Two types of flaxseed are available in the world which differ in especially by them color namely golden and

2. Codină G.G., Mironeasa S., 2017, *Bread quality and Alveograph rheological properties of composite flour made from flaxseed and wheat of 650 type of a strong quality for bread making* submitted in order to be presented and published to the conference proceeding at the 4th International Conference on Food Security and Nutrition (ICFSN 2017) that will be held in Prague, Czech Republic during March 13-15, 2017 (<http://www.icfsn.org/>)

● ICFSN <icfsn@cbees.net>  
To: Georgiana Codina

Nov 28 at 5:02 AM

Dear Codina,

Thanks for your submission paper "Bread quality and Alveograph rheological properties of composite flour made from flaxseed and wheat of 650 type of a strong quality for bread making" to ICFSN 2017. Your paper looks nicely prepared and has already passed the preliminary review of the conference committee, which will then enter the further peer review process performed by international reviewers in related fields. And you'll be informed of the review result by the notification date Dec 25, 2016.

By the way, your paper is given the paper ID: S2013. Keep your paper ID in mind and feel free to contact me should you have any query about your paper any time.

Yours faithfully,

--

If you need more information about the conference, please visit our website <http://www.icfsn.org/>.

Lydia Liu

Conference Specialist

ICFSN 2017

ACBEES

For the ***brown flaxseed flour addition in wheat flour***:

1. Codină G.G., Mironeasa S., Todosi-Sănduleac E., *Studies regarding the influence of brown flaxseed flour addition in wheat flour of a very good quality for bread making on bread quality*, oral presentation at The 15th International Symposium Prospects for the 3rd millennium agriculture, 29th September - 1st October, 2016, Cluj-Napoca, Romania, accepted for publication in Bulletin of University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca. Food science and technology, ISSN 2344-2344.

Available online: [http://symposium.usamvcluj.ro/images/Symposium\\_program.pdf](http://symposium.usamvcluj.ro/images/Symposium_program.pdf)  
<http://symposium.usamvcluj.ro/Book%20of%20abstract%202016.pdf>

● **Sonia SOCACI** <sonia.socaci@usamvcluj.ro>

To: Hello Georgiana Gabriela Codina

Hello Georgiana Gabriela Codina:

We have reached a decision regarding your submission to Bulletin of University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca. Food Science and Technology, "Studies regarding the influence of brown flaxseed flour addition in wheat flour of a very good quality for bread making on bread quality".

Our decision is to: Accept submission.

Best regards,

Sonia SOCACI

University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca

Phone 0745472589

[sonia.socaci@usamvcluj.ro](mailto:sonia.socaci@usamvcluj.ro)

2. Codină G.G., Mironeasa S., 2017, *Bread quality and Alveograph rheological properties of composite flour made from flaxseed and wheat of 650 type of a strong quality for bread making* submitted in order to be presented and published to the conference proceeding at the 4th International Conference on Food Security and Nutrition (ICFSN 2017) that will be held in Prague, Czech Republic during March 13-15, 2017 (<http://www.icfsn.org/>)

Dear Codina,

Thanks for your submission paper "Bread quality and Alveograph rheological properties of composite flour made from flaxseed and wheat of 650 type of a strong quality for bread making" to ICFSN 2017. Your paper looks nicely prepared and has already passed the preliminary review of the conference committee, which will then enter the further peer review process performed by international reviewers in related fields. And you'll be informed of the review result by the notification date Dec 25, 2016.

By the way, your paper is given the paper ID: S2013. Keep your paper ID in mind and feel free to contact me should you have any query about your paper any time.

Yours faithfully,

--

If you need more information about the conference, please visit our website <http://www.icfsn.org/>.

Iydia Iiu

Conference Specialist

ICFSN 2017

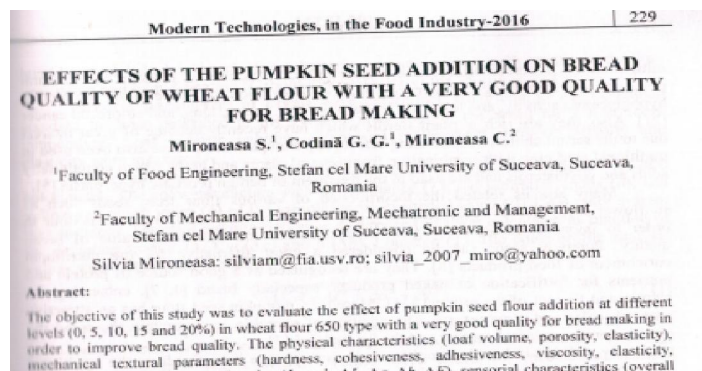
APCBEEES

For the **pumpkin seed flour addition in wheat flour**:

1. Codinã G.G., Mironeasa S., 2016, *Application of D-Optimal Mixture Design to optimize the wheat-pumpkin composite flour for bread production*, Food and Environment Safety, 15 (1): 10-20

Available online: <http://www.fia.usv.ro/fiajournal/>

2. Mironeasa S., Codinã G.G., Mironeasa C., 2016, *Effects of the pumpkin seed addition on bread quality of wheat flour with a very good quality for bread making*, oral presentation at the International Conference Modern technologies in the food industry, 20th October - 22th October, 2016, Chișinău, published in Conference Proceeding, p. 229-237, ISBN 978-9975-87-138-9.



3. Mironeasa S., Codinã G.G., *Evaluation the effects of pumpkin seed flour addition in wheat flour of a strong quality for bread making on bread quality*, SGEM International Conferences Vienna Green, 2th November - 5th November, 2016, Vienna, Austria, oral presentation published in the Conference Proceeding (Book 6 Nano, Bio and Green-Technologies for a sustainable Future, vol. III) pp. 261-269, submitted for evaluation and indexation in the scientific databases – ISI Web of Sciences, Thomson Reuters, Scopus, Elsevier products, Ebsco, ProQuest, Mendeley, British Library, etc.

Available online programme conference:

<http://www.sgemviennagreen.org/index.php/sgemviennagreen-deadlines/conference-agenda-menu>

For the **mustard seed flour addition in wheat flour**:

Codinã G.G., Mironeasa S., Mironeasa C., *The alveograph rheological properties and bread quality of composite defatted mustard - wheat flour*, SGEM International Conferences Vienna Green, 2th November - 5th November, 2016, Vienna, Austria, oral presentation published in the Conference Proceeding (Book 6 Nano, Bio and Green-Technologies for a sustainable Future, vol. III) pp. 355-363, submitted for evaluation and indexation in the

scientific databases – ISI Web of Sciences, Thomson Reuters, Scopus, Elsevier products, Ebsco, ProQuest, Mendeley, British Library, etc.

Available online programme conference:

<http://www.sgemviennagreen.org/index.php/sgemviennagreen-deadlines/conference-agenda-menu>

#### Conclusions

All the research objectives proposed in Annex IV of Contract No. 53/01.10.2015 for the period October 2015-December 2016 were completed.

Up to December 2016 the research activities from this project were published or presented at different conferences in 3 articles quoted ISI with impact factor (2 published and 1 accepted), in 1 article in a journal indexed in different international databases in 2 articles accepted in a journal indexed in different international databases, requirement for 2 patents submitted to OSIM for evaluation, 1 book, 2 presentation at an international conference as poster presentation, 6 presentation at different international conferences as oral presentation, 4 articles published in conference proceeding book (from which 2 submitted for indexation in ISI Web of Sciences) and 1 article submitted to be oral presented and published in the conference proceedings at an international conference.

#### References (minimal):

1. Codină G.G., Mironeasa S., Mironeasa C., 2012, *Variability and relationship among Mixolab and Falling Number evaluation based on influence of fungal alpha-amylase addition*, J. Sci. Food. Agric. 92: 2162-2170
2. Dhiman, A.K., Sharma K.D., Attri S., 2009, *Functional constituents and processing of pumpkin: A review*, Journal of Food Science and Technology, 46(5):411-417
3. El Adawy T. A., Taha K. M., 2001, *Characteristics and composition of different seed oils and flours*, Food Chemistry, 74: 47-54
4. Gadei G., Gaceu L., Gruia R., 2012, *Preliminary research regarding the impact of mustard flour addition in bread*, J. EcoAgriTourism 8: 135-139
5. Marpalle P, Sonawane S.K., Arya S.S., 2014, *Effect of flaxseed flour addition on physicochemical and sensory properties of functional bread*, LWT-Food Sci Technol 58: 614-619
6. Mastromatteo M., Danza A., Lecce L., Spinelli S., Lampignano V., Laverse J., Conte A. Del Nobile M. A., 2015, *Nutritional and physicochemical characteristics of wholemeal bread enriched with pea flour*, Int J Food Sci Technol, 50: 92-102
7. Persia M.E., Parsons C.M., Schang M., Azcona J., 2003, *Nutritional evaluation of dried tomato seeds*, Poult Sci. 82(1): 141-146
8. Scanlon M.G., Zghal M.C., 2001, *Bread properties and crumb structure*, Food Research International 34 (10): 841-864
9. Tyagi, S.K., Manikantan, M.R., Oberoi H.S., Kaur G., 2007, *Effect of mustard flour incorporation on nutritional, textural and organoleptic characteristics of biscuits*, J. Food Eng. 80:1043-1050
10. Xu Y., Hall C.A., Manthey F.A., 2014, *Effect of flaxseed flour on rheological properties of wheat flour dough and on bread characteristics*, J. Food Res 3:83-91

**Project director:**

Associate Prof. Ph.D. Eng. Georgiana Gabriela CODINĂ