



PEOPLE'S DEMOCRATIC REPUBLIC OF ALGERIA  
MINISTRY OF HIGHER EDUCATION AND SCIENTIFIC RESEARCH  
UNIVERSITY OF CONSTANTINE 3 SALAH BOUBNIDER  
FACULTY OF MEDICINE  
DEPARTMENT OF PHARMACY



THESIS FOR OBTAINING THE DIPLOMA OF DOCTOR OF PHARMACY

# *MINERAL ADDITIVES IN INDUSTRIAL FOODS*

Presented by the 6th year pharmacy students:

- MADAOUY KARIM
- MATMAT LOKMANE YAHIA

Supervised by:

- Dr. KHARROUBI LATIFA University hospital Assistant professor in mineral chemistry.

Members of the jury:

- Dr. KERRADA AMINA University hospital Assistant professor in pharmacology.
- Dr. BOUKERZAZA IMEN University hospital Assistant professor in hydro bromatology.

Thesis Defended on: 17/06/2025

Academic Year: 2024-2025

|           |                                                                                                                                |    |
|-----------|--------------------------------------------------------------------------------------------------------------------------------|----|
| I.7.15.   | Food Acids .....                                                                                                               | 11 |
| I.7.16.   | Gelling Agents.....                                                                                                            | 11 |
| I.7.17.   | Glazing Agents .....                                                                                                           | 11 |
| I.7.18.   | Humectants .....                                                                                                               | 12 |
| I.7.19.   | Leavening Agents.....                                                                                                          | 12 |
| I.7.20.   | Preservatives .....                                                                                                            | 12 |
| I.7.21.   | Propellants.....                                                                                                               | 12 |
| I.7.22.   | Sequestrants.....                                                                                                              | 12 |
| I.7.23.   | Stabilizers.....                                                                                                               | 13 |
| I.7.24.   | Sweeteners .....                                                                                                               | 13 |
| I.7.25.   | Thickeners .....                                                                                                               | 13 |
| I.8.      | The Halal Notion for Food Additives .....                                                                                      | 13 |
| I.9.      | conditions for labeling food additives in foodstuffs according to Algerian regulations .....                                   | 14 |
| I.9.1.    | The Law and the Rule of Law.....                                                                                               | 14 |
| I.9.2.    | The Basics of Legislation and Quality Control in Algeria .....                                                                 | 14 |
| I.9.2.1.  | Law No. 09-03 of 25 February 2009 on Consumer Protection and Fraud Control [74]                                                | 14 |
| I.9.2.2.  | Health Protection (Law No. 18-11 of 2 July 2018 on Health) [75].....                                                           | 15 |
| I.9.2.3.  | Phytosanitary (Law No. 87-17 of 1 August 1987 on Phytosanitary Protection) [76] ....                                           | 15 |
| I.9.2.4.  | Animal Health (Law No. 88-08 of 26 January 1988 Relating to Veterinary Medicine and the Protection of Animal Health) [77]..... | 15 |
| II.1.     | Definition of Mineral Food Additives .....                                                                                     | 17 |
| II.2.     | Classification of Mineral Food Additives .....                                                                                 | 17 |
| II.2.1.   | Sulfur Food Additive Compounds.....                                                                                            | 17 |
| II.2.2.   | Calcium Food Additive Compounds .....                                                                                          | 17 |
| II.2.3.   | Iodine Food Additive Compounds .....                                                                                           | 18 |
| II.2.4.   | Magnesium Food Additive Compounds .....                                                                                        | 18 |
| II.2.5.   | Potassium Food Additive Compounds.....                                                                                         | 18 |
| II.2.6.   | Sodium Food Additive Compounds .....                                                                                           | 18 |
| II.2.7.   | Chloride Food additive Compounds .....                                                                                         | 19 |
| II.2.8.   | Phosphorus Food Additive Compounds .....                                                                                       | 19 |
| II.3.     | Importance of Essential Minerals in Human Nutrition.....                                                                       | 19 |
| II.4.     | Nutritional Labeling Requirments in Algeria .....                                                                              | 20 |
| II.5.     | Functionalities Of Mineral Food Additives .....                                                                                | 20 |
| II.5.1.   | The Duality in the usage of mineral food additives.....                                                                        | 20 |
| II.5.1.1. | Dose Dependency.....                                                                                                           | 20 |
| II.5.1.2. | Bioavailability .....                                                                                                          | 20 |

---

|            |                                                                                                                           |    |
|------------|---------------------------------------------------------------------------------------------------------------------------|----|
| II.5.1.3.  | Intent .....                                                                                                              | 20 |
| II.5.2.    | classification of mineral food additives based on their functions.....                                                    | 21 |
| II.5.2.1.  | Preservatives .....                                                                                                       | 21 |
| II.5.2.2.  | Color Retention Agents .....                                                                                              | 24 |
| II.5.2.3.  | Acidity Regulators.....                                                                                                   | 25 |
| II.5.2.4.  | Anticaking Agents .....                                                                                                   | 27 |
| II.5.2.5.  | Antioxidant Agents .....                                                                                                  | 28 |
| II.5.2.6.  | Stabilizers.....                                                                                                          | 28 |
| II.5.2.7.  | Bleaching Agents .....                                                                                                    | 28 |
| II.5.2.8.  | Emulsifiers/Emulsifying Salts.....                                                                                        | 29 |
| II.5.2.9.  | Firming Agents.....                                                                                                       | 29 |
| II.5.2.10. | Flavor Enhancers .....                                                                                                    | 29 |
| II.5.2.11. | Flour Treatment Agents.....                                                                                               | 29 |
| II.5.2.12. | Food Acids .....                                                                                                          | 29 |
| II.5.2.13. | Propellants.....                                                                                                          | 30 |
| II.5.3.    | Some Of The Most Commonly Used Harmful Mineral Additives .....                                                            | 30 |
| II.5.3.1.  | Sodium Nitrite (INS 250).....                                                                                             | 30 |
| II.5.3.2.  | Potassium Iodate (INS 917) .....                                                                                          | 31 |
| II.5.3.3.  | Titanium Dioxide (INS 171).....                                                                                           | 32 |
| II.5.3.4.  | Sulfur Dioxide (INS 220).....                                                                                             | 32 |
| II.5.3.5.  | Sodium Metabisulfite (INS 223).....                                                                                       | 33 |
| III.1.     | Objectives .....                                                                                                          | 36 |
| III.2.     | Materials & Methods .....                                                                                                 | 36 |
| III.2.1.   | Research on mineral food additives present in industrial food products marketed in<br>Algeria (Constantine region): ..... | 36 |
| III.2.2.   | Type of study : .....                                                                                                     | 36 |
| III.2.3.   | Data Collection : .....                                                                                                   | 36 |
| III.2.4.   | Graphical representation of data : .....                                                                                  | 36 |
| IV.1.      | Study of the compliance of food additive labeling:.....                                                                   | 39 |
| IV.2.      | representation and discussion of research results .....                                                                   | 41 |
| IV.2.1.    | Bread products .....                                                                                                      | 41 |
| IV.2.1.1.  | Representation in tables and graphs.....                                                                                  | 41 |
| IV.2.1.2.  | Discussion of tables and graphs .....                                                                                     | 42 |
| IV.2.2.    | Canned Food Products .....                                                                                                | 42 |
| IV.2.2.1.  | Representation in tables and graphs.....                                                                                  | 42 |
| IV.2.2.2.  | Discussion of tables and graphs .....                                                                                     | 44 |

---

|            |                                          |    |
|------------|------------------------------------------|----|
| IV.2.3.    | Cereal Products .....                    | 45 |
| IV.2.3.1.  | Representation in tables and graphs..... | 45 |
| IV.2.3.2.  | Discussion of tables and graphs .....    | 46 |
| IV.2.4.    | Condiments .....                         | 46 |
| IV.2.4.1.  | Representation in tables and graphs..... | 46 |
| IV.2.4.2.  | Discussion of tables and graphs .....    | 48 |
| IV.2.5.    | Cream Products .....                     | 49 |
| IV.2.5.1.  | Representation in tables and graphs..... | 49 |
| IV.2.5.2.  | Discussion of tables and graphs .....    | 50 |
| IV.2.6.    | Energy Drinks.....                       | 51 |
| IV.2.6.1.  | Representation in tables and graphs..... | 51 |
| IV.2.6.2.  | Discussion of tables and graphs .....    | 52 |
| IV.2.7.    | Juice .....                              | 53 |
| IV.2.7.1.  | Representation in tables and graphs..... | 53 |
| IV.2.7.2.  | Discussion of tables and graphs .....    | 55 |
| IV.2.8.    | Noodles.....                             | 56 |
| IV.2.8.1.  | Representation in tables and graphs..... | 56 |
| IV.2.8.2.  | Discussion of tables and graphs .....    | 57 |
| IV.2.9.    | Pastery .....                            | 58 |
| IV.2.9.1.  | Representation in tables and graphs..... | 58 |
| IV.2.9.2.  | Discussion of tables and graphs .....    | 60 |
| IV.2.10.   | Snacks .....                             | 61 |
| IV.2.10.1. | Representation in tables and graphs..... | 61 |
| IV.2.10.2. | Discussion of tables and graphs .....    | 63 |
| IV.2.11.   | Hard Cheese .....                        | 64 |
| IV.2.11.1. | Representation in tables and graphs..... | 64 |
| IV.2.11.2. | Discussion of tables and graphs .....    | 65 |
| IV.2.12.   | Soft Cheese .....                        | 66 |
| IV.2.12.1. | Representation in tables and graphs..... | 66 |
| IV.2.12.2. | Discussion of tables and graphs .....    | 69 |
| IV.2.13.   | Soft Drinks .....                        | 70 |
| IV.2.13.1. | Representation in tables and graphs..... | 70 |
| IV.2.13.2. | Discussion of tables and graphs .....    | 72 |
| IV.2.14.   | Yogurt .....                             | 73 |
| IV.2.14.1. | Representation in tables and graphs..... | 73 |
| IV.2.14.2. | Discussion of tables and graphs .....    | 74 |

|                                                                            |     |
|----------------------------------------------------------------------------|-----|
| IV.3. Recapitulation .....                                                 | 75  |
| IV.3.1. According to the functional aspect of mineral food additives ..... | 75  |
| IV.3.1.1. Graphical representation .....                                   | 75  |
| IV.3.1.2. Discussion of the graph .....                                    | 76  |
| IV.3.2. according to the nutritional aspect of mineral food additives..... | 77  |
| V.1. CONCLUSION: .....                                                     | 81  |
| Bibliographic references and webography :.....                             | 84  |
| Thesis Appendix:.....                                                      | 94  |
| Appendix N°1:.....                                                         | 94  |
| Appendix N°2:.....                                                         | 96  |
| Appendix N°3:.....                                                         | 98  |
| Appendix N°4:.....                                                         | 98  |
| Appendix N°5:.....                                                         | 99  |
| Appendix N°6:.....                                                         | 100 |
| Appendix N°7:.....                                                         | 101 |
| Appendix N°8:.....                                                         | 102 |
| Appendix N°9:.....                                                         | 103 |
| Appendix N°10:.....                                                        | 104 |
| Summary :.....                                                             | 106 |

---

## Summary :

Our thesis titled "Mineral Additives in Industrial Foods" investigates the role, prevalence, and health implications of mineral food additives in processed foods, specifically within the Constantine region of Algeria. Conducted over a detailed period of three months, our research involved an extensive descriptive study, analyzing approximately 700 different industrial food products from multiple categories and brands. Each product's label was carefully examined to identify both nutritional and technological mineral additives, and compliance with Algerian labeling regulations was evaluated. The findings revealed notable discrepancies in labeling compliance, as several products lacked the required clarity or accuracy in disclosing additive content. Additionally, mineral additives such as sodium carbonates, polyphosphates, and sulfites were frequently identified, indicating their widespread usage primarily as emulsifying salts, preservatives, and acidity regulators. The study underscored significant health concerns associated with excessive or improper consumption of certain additives like sodium nitrite and titanium dioxide. Our thesis advocates for improved regulatory oversight and increased consumer awareness to mitigate potential health risks linked to these industrial mineral food additives.

Key Words: mineral additives, industrial Foods, health implications

## Résumé:

Notre thèse, intitulée « Additifs minéraux dans les aliments industriels », examine le rôle, la prévalence et les implications sanitaires des additifs minéraux dans les aliments transformés, notamment dans la région de Constantine, en Algérie. Menée sur une période détaillée de trois mois, notre recherche a consisté en une étude descriptive approfondie, analysant environ 700 produits alimentaires industriels différents, appartenant à de multiples catégories et marques. L'étiquette de chaque produit a été soigneusement examinée afin d'identifier les additifs minéraux nutritionnels et technologiques, et la conformité à la réglementation algérienne en matière d'étiquetage a été évaluée. Les résultats ont révélé des écarts notables dans la conformité de

l'étiquetage, plusieurs produits manquant de clarté ou d'exactitude dans la divulgation de la teneur en additifs. De plus, des additifs minéraux tels que les carbonates de sodium, les polyphosphates et les sulfites ont été fréquemment identifiés, ce qui témoigne de leur utilisation répandue, principalement comme sels émulsifiants, conservateurs et correcteurs d'acidité. L'étude a mis en évidence d'importants problèmes de santé liés à la consommation excessive ou inappropriée de certains additifs comme le nitrite de sodium et le dioxyde de titane. Notre thèse préconise un renforcement de la surveillance réglementaire et une sensibilisation accrue des consommateurs afin de limiter les risques potentiels pour la santé liés à ces additifs alimentaires minéraux industriels.

Mots-clés : additifs minéraux, implications pour la santé, aliments industriels

## ملخص

تبحث أطروحتنا بعنوان "المضافات المعدنية في الأغذية الصناعية" في دور المضافات الغذائية المعدنية في الأغذية المصنعة، وانتشارها، وآثارها الصحية، لا سيما في منطقة قسنطينة بالجزائر. استغرق بحثنا ثلاثة أشهر، وشملت دراسة وصفية موسعة، حللت ما يقارب 700 منتج غذائي صناعي مختلف من فئات وعلامات تجارية متعددة. فُحصت ملصقات كل منتج بعناية لتحديد المضافات المعدنية الغذائية والتكنولوجية، وقُيِّم مدى امتثالها للوائح وضع العلامات الجزائرية. كشفت النتائج عن تباينات ملحوظة في امتثال الملصقات، حيث افترقت العديد من المنتجات إلى الوضوح أو الدقة المطلوبين في الكشف عن محتوى المضافات. بالإضافة إلى ذلك، تم تحديد المضافات المعدنية، مثل كربونات الصوديوم، والبولي فوسفات، والكبريتيت، بشكل متكرر، مما يشير إلى استخدامها على نطاق واسع، في المقام الأول كأملح مستحلبة، ومواد حافظة، ومنظمات حموضة. أبرزت الدراسة المخاوف الصحية الكبيرة المرتبطة بالإفراط في استهلاك بعض المضافات، مثل نترات الصوديوم وثاني أكسيد التيتانيوم، أو بشكل غير صحيح. تدعو أطروحتنا إلى تحسين الرقابة التنظيمية وزيادة وعي المستهلك للتخفيف من المخاطر الصحية المحتملة المرتبطة بهذه الإضافات الغذائية المعدنية الصناعية.

الكلمات المفتاحية: المضافات المعدنية، الأطعمة الصناعية، الآثار الصحية