



Food additives and food safety: an analysis of the controversy

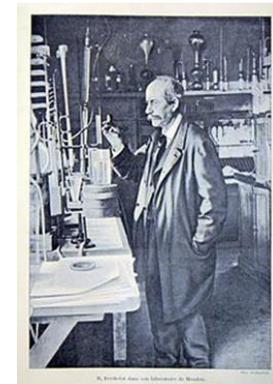
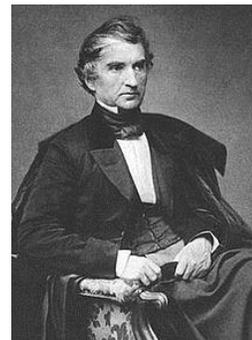
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Historical context

- Building an «historical epistemology » (Bachelard, 1934)
- Since the 19th century, food industry has developed :
 - ❑ Nicolas Appert invents the canning in 1806,
 - ❑ Justin von Liebig develops the « chemistry of food » in 1847
 - ❑ in 1909 Marcelin Berthelot imagines for the 21st century a new world where the chemistry takes the place of the agriculture to feed Humanity.
- The question of the risks associated with technological progress is a very old one. The history of sciences and technologies clearly shows that
 - ❑ new technologies and scientific knowledge improve the conditions of life of mankind,
 - ❑ but also create new dangers - process of « creative destruction » (Schumpeter, 1942 ; Jarrige, Le Roux, 2017; Le Roux 2016dir).



Food additives: current subject of a controversy

- We focus on titanium dioxide (E171) – France is one of the first country to suspend its use – art.53 Egalim Law, November 1, 2018
- However, the French Ministry in charge of consumption did not publish the ministry order, considering some recent conclusions of EFSA and waiting for new results.

Aims of the research program:

- 1) Analyse the content of the controversy
- 2) Contribute to a better understanding of public decisions regarding risk assessment related to food safety, and of the behaviours and influence of the main stakeholders: regulation agencies, academics, associations/Ngos, Companies

Food additives: definition

- Food additives are substances that are not normally consumed as food itself but are added to food intentionally for a technological purpose (for example to color, to sweeten or to help preserve foods)
- In the European Union (EU) all food additives approved for use are identified by an E number.

- Several groups :

- **Color additives** E100-199
- Preservatives E200-299
- Antioxidant E300-399
- Acidity regulators E300-399
- flavor enhancer E600-699
- flavors No number



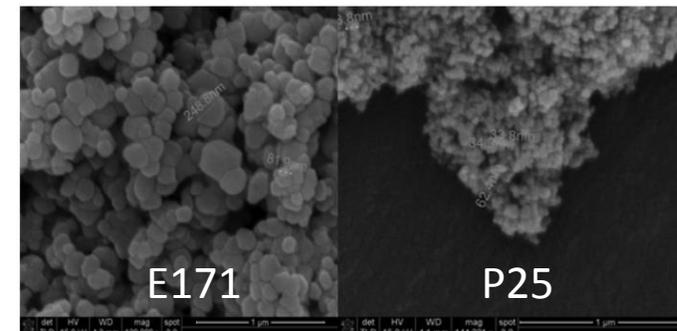
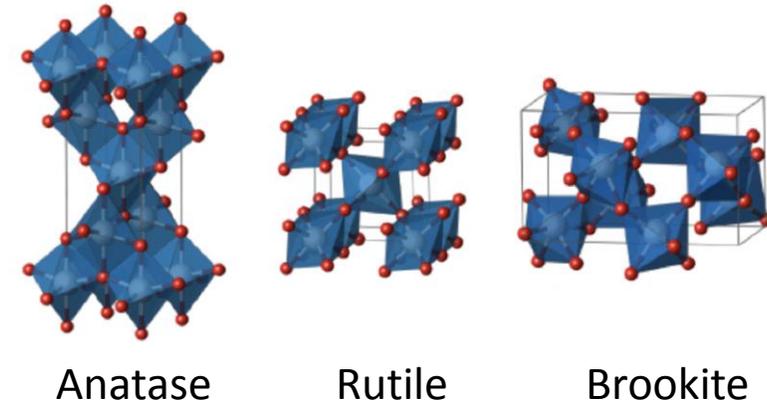
Color additives

- They are used to:
 - improve appearance of food
 - replace colour lost in processing
 - satisfy consumer expectations
 - give colour to food that would be colourless
- Some are natural
 - Chlorophyll (E140), carotene (E160) or cochineal (E120)
- Some are artificial
 - Tartrazine (E102) or titanium dioxide (E171)



Titanium dioxide TiO_2 (E171)

- Used as a whitening and brightening agent in confectionary (candies and chewing gum), white sauces and icing.
- First approved for use in food by the United States Food and Drug Administration (FDA) in **1966**, then by the EU in **1969**.
- Various crystal forms and size
 - only anatase and rutile used in food
- Various size
 - Microparticule (MP): size > 100 nm
 - for food application mean size > 250 nm
 - Nanoparticle (NP): one dimension < 100 nm
 - example P25 used for photocatalysis applications



1- context

Titanium dioxide TiO_2 (E171)

- Recent studies revealed that E171 could contain up to 36% of NP
- P25 100% NP

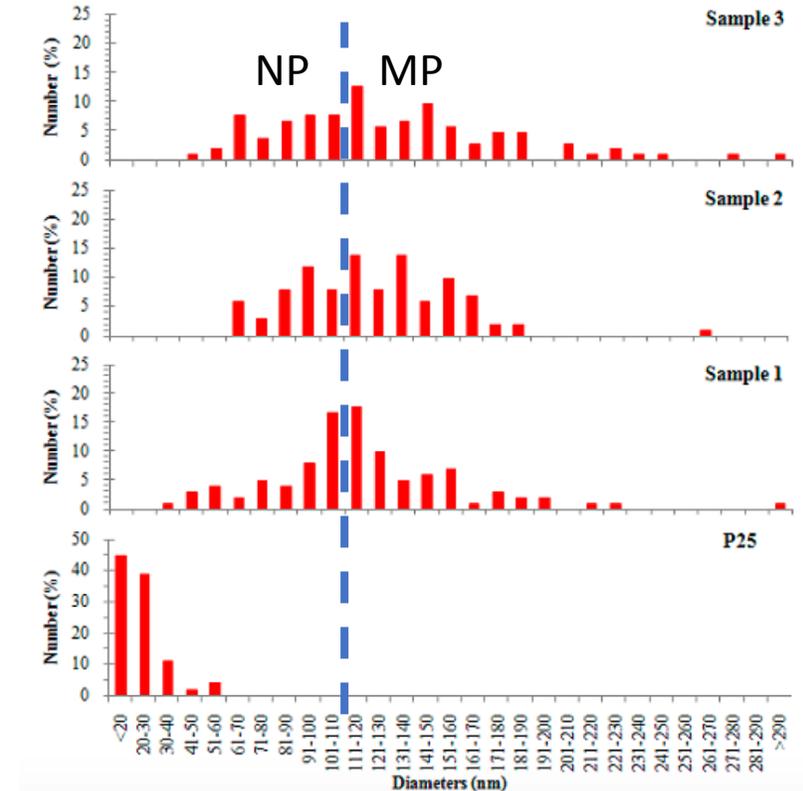


Two different kinds of TiO_2

- Literature on TiO_2 biological effects
 - based on P25 and E171



testing should focus on E171 to obtain relevant results as well as in food matrix



The controversy regarding the use of TiO_2 is then related to the risks associated with the use of nanotechnology in agroindustry

Methodology of investigation : Sociology of controversies and Economics & Management of innovation



Sociology of controversies (Latour, 1984; Callon, Latour, 1991eds; Callon, 1981)

Knowledge production is a social construction, not a linear one, and involves a large number of stakeholders, theories and points of view. Controversies represent a learning process between various stakeholders.

The main questions are:

- 1/ Who are the stakeholders of the controversy?,
- 2/ What are their different positions and arguments?,
- 3/ What are the relations between these various stakeholders (scientific, financial, political and so on),
- 4/ What are the impacts of controversies for the various stakeholder's? E.g. On the nature of the knowledge produced, on the behaviours of firms?



Economics and Management of Innovation (Dosi, 1982, RRI, 2013, Laperche, 2017)

What is the impact of the controversy on the innovation process: is it an incentive or a barrier to innovate in the food sector? How do firms innovate and develop their “knowledge capital” to face the controversy? What is the impact on innovation/ technological trajectories in the related sectors?

REGULATION AGENCIES

2006: IARC classified TiO₂ as a possible human carcinogen in Groupe 2B after inhalation (possible carcinogen for humans)

2015: ANSES submitted a proposal to ECHA to classify TiO₂ as a category 1B carcinogen by inhalation, but actually remains in Group 2

2016 & 2018: EFSA E171 as a food additive after publication of 4 new studies on its potential toxicity - outcome : no change. Recommendation of further studies

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NON PROFIT & CONSUMERS

On 24 December 2018 a collective of associations published a call in *Le Monde* exhorting the French government to ban the use of E171

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ACADEMICS

Recent studies underline that testing should focus on TiO₂ food grade to obtain relevant results rather than on P25 TiO₂

2017: Betteni et al. (2017). Study performed on TiO₂ food grade emphasize that oral exposure to TiO₂-based food additives should be investigated for human risk assessment

What is the position of states ?

POSITION OF STATES

France to suspend its use – art.53 Egalim Law, November 1, 2018

However, the French Ministry in charge of consumption did not publish the ministry order, considering some recent conclusions of EFSA and waiting for new results.

Final decision should be taken in France on April 15 2019

What is the position of companies?

COMPANIES

The French confectioners' union adopted in 2018 a charter of ethics including the decision to ban E171 by 2020
Several Companies have already replaced it. E.G. Verquin, Haribo for candies

Are there financial, scientific or political links between the various stakeholders?

What are the impacts of the controversy on each stakeholder?

Questions and perspectives

- What are the links between these various stakeholders and what their impact on the controversy? *Characteristics of regulatory science*
 - The decisions taken by regulatory agencies are the result of specific assessment and tests achieved by regulatory bodies and the result of academic studies. This generates a category of science called “Regulatory science” (Demortain, 2017)
 - Influence of firms linked to the characteristics of regulation – REACH (Boullier, 2019)
 - We plan interviews with regulatory agencies (ANSES, EFSA) to better understand the process of expertise
- Behaviours of firms regarding the innovation trajectories, the constitution of their Knowledge capital.
 - Identification of difficulties to change (new recipes, new substitutes, new authorizations (for example Mars for M&Ms)
 - What incentives? The French confectioners’ union plans to develop a special fund to give incentives to small firms.
 - Interviews with firms are planned

References

- BETTINI S *et al.*, Food-grade TiO₂ impairs intestinal and systemic immune homeostasis, initiates preneoplastic lesions and promotes aberrant crypt development in the rat colon. *Sci Rep.* 20;7:40373, 2017. DOI: 10.1038/srep40373.
- BOULIER H., *Toxiques légaux. Comment les firmes chimiques ont mis la main sur le contrôle de leurs produits*, La découverte, 2019.
- CALLON M., Pour une sociologie des controverses technologiques, in Akrich M., Callon M., Latour B., *Sociologie de la traduction*, Presse des mines, 2006, pp. 135-157.
- DEMORTAIN B., Expertise, Regulatory Science and Evaluation of Technology and Risks: an introduction to the special issue, *Minerva*, 55, 2017, pp.139-159.
- EFSA Panel on Food Additives and Nutrient Sources added to Food (ANS) Re-evaluation of titanium dioxide (E 171) as a food additive. *EFSA Journal*, 14(9), 2016, e04545. DOI:10.2903/j.efsa.2016.4545.
- KAISER M. et al., *Governing future technologies, nanotechnology and the rise of an assessment regime*, Springer, 2010.
- LAPERCHE B., *Enterprise Knowledge Capital*, Iste-Wiley, 2017.
- LATOURE B., *Sur la pratique des théoriciens*, Presses Universitaires de France. 2011, Paris.
- MINISTERE DE L'AGRICULTURE ET DE L'ALIMENTATION, *Nanotechnologies et nanomatériaux en alimentation : atouts, risques, perspectives*, Centre d'études et de prospective, n°120, mai 2018.
- REGULATION (EC) No 1333/2008 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 16 December 2008 on food additives.