

Harmonising stakeholder's preferences, needs and acceptance on sustainability and technical aspects to develop specifications for biodegradable packaging material

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Abstract

For the development of new biodegradable packaging materials and decision support tools, expectations, requirements and knowledge of different disciplines need to be harmonized and integrated.

Within the EU funded EcoBioCAP project a systematic approach was applied. Packaging development brief was developed, technical and consumer survey was carried out. Specifications are used as a starting point for carrying out the research tasks in a harmonized way.

For a systematic approach for setting the targets of the research and considering technical requirements and consumers needs, the use of these management tools is essential in the early phase of the research and development projects.

Keywords: management tools; packaging material; biodegradable; specification; packaging development brief

1. Introduction

The objective of the **EcoBioCAP (Ecoefficient Biodegradable Composite Advanced Packaging) FP7 project** is to develop a **new biodegradable packaging** using advanced composite structures based on constituents derived from the food industry by-products only and by applying innovative processing strategies to enable customisation of the packaging properties to fit the functional, cost, safety and environmental impact requirements of the targeted fresh perishable food.

This article aims to give a general guidance on the procedure that helps the first steps of the research and development process which is essential in the starting stage of the work.

For the development of new biodegradable packaging materials and decision support tools the expectations, requirements and knowledge of the different disciplines should be harmonized and integrated. This is

necessary for projects within a company, but integration is also important in collaborative European research projects where the knowledge of different disciplines is represented by different organisations from different countries. The physical distance between the workplaces of the project partners prevents frequent physical meeting between the representatives of the different disciplines. Therefore the adaptation of the methods applied at industry product development activities may provide benefits for international research projects. There are practical management tools, like targeted documents, that help to establish the main purposes of the research and the development work. Packaging specification is an important management tool that contains a clear establishment of all the packaging material properties that are important for the producers, consumers and for traders, and clear establishment of all the requirements of the production (quality, food safety, packaging, labelling...). These specifications are the basis of the research and the experimental trials during the development of the biodegradable packaging materials.

A systematic approach can be applied for developing the first stage specifications. In this article an overview of the whole process is provided discussing the role of the different documents and the necessary information in detail that are necessary for building up a packaging specification. The issues are presented through the example of the progress in the EcoBioCAP project.

2. Material and Methods

At the beginning of the EcoBioCAP project, four different types of food products were specified for which the new, biodegradable packaging materials are intended to be developed. The specified food products are strawberries, mushrooms, cheeses and ready-to-eat sandwiches.

At the beginning of the project the ultimate objective of this activity within the project was defined as to develop packaging specifications - packaging requirements for maintaining quality and safety of respiring and inert fresh foods and for responding to stakeholders' preferences, acceptances and needs which can be used as agreed basis for further research work.

Packaging specification is a management tool which is very important to:

- to provide precise description of all essential properties,
- to specify the details in a written form,
- to prevent misunderstandings,
- to help the identification of the gaps in the information,
- to deliver information to packaging material manufacturers, to users, to the food manufacturing companies, to retailers and to the consumers. (Andrew Bolton, 1997)

The systematic method adopted to elaborate these packaging specifications was a multistep approach based on developing the first packaging development briefs used as a basis for further elaboration of questionnaires for stakeholders surveys (technical and consumer surveys), which were complemented by collecting and analysing information on by-products, biopackaging solutions and foods characteristics from the project partners and from the literature and also by carrying out experimental work.

Figure 1 shows the schematic way of the development of the packaging specifications.

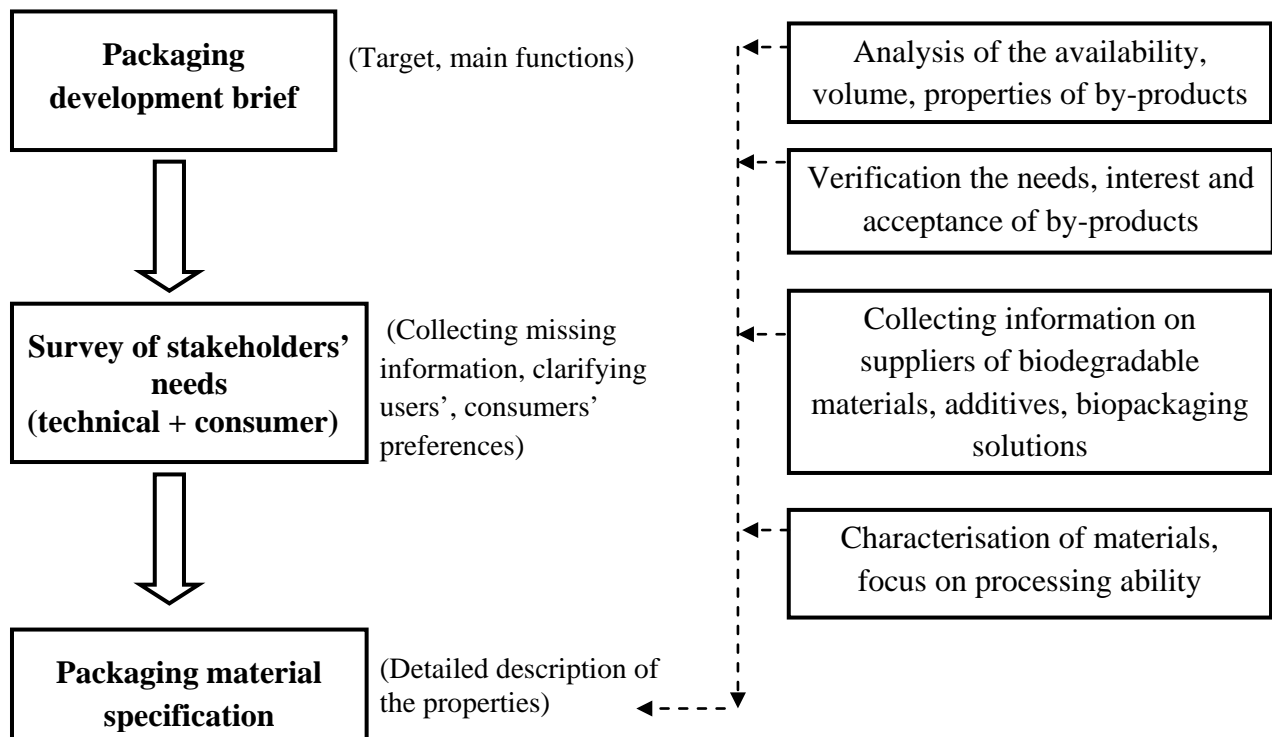


Figure 1: The schematic way for preparation of the packaging specifications

The packaging development brief is a document, where the targets and the outcomes of the development activities are specified as a first step before any detailed technical/research work on biodegradable packaging solutions, which need more time and efforts to work out. (R. Shaw, 1996) The technical survey is intended to map and analyse the stakeholders' preferences, acceptances and needs, which help to prepare the specifications for each biodegradable packaging solution. The technical survey focused on requirements of the project partners related to the biodegradable packaging solutions and covered mostly scientific and technical questions. The consumer survey contains interviews to collect information about the interest of the consumers and about their needs related to the biodegradable packaging materials.

The process for developing the packaging development briefs and for carrying out the surveys started with developing templates for all the different kind of management tools which contained all the necessary questions in a clear and understandable way. The templates and draft versions were circulated and discussed between the project partners. After the project partners agreed in the final documents, the completion of the different templates and questionnaires was started.

After the final template was developed regarding to the packaging development brief, the project partners who were responsible for the specified food products completed the template for cheeses, for strawberries, for mushrooms and for ready-to-eat sandwiches for the aimed packaging solutions. The answers were discussed with the stakeholders to get them verified.

For the technical survey, a detailed questionnaire was also developed by the project partners then all of the partners completed those sections of the questionnaire for which they had the appropriate knowledge and

which were relevant for them. An additional survey was carried out on some aspects of the quality and safety of the model food products and collected the knowledge and data available from the partners. An analyses and an evaluation was carried out on the potential use of by-products (availability, volume, properties, potential safety concerns, interest and acceptance of by-products, regulatory constraints) and on the applicability of biodegradable materials, additives (current suppliers and biopackaging solutions, processing and physical properties of the constituents, characterisation of materials, processing ability). As a result of the collective work, completed technical questionnaires were obtained for all the products for each part of the packaging solutions, for each different material.

The consumer survey was focused on the preference of the consumers' and their needs related to the biodegradable packaging materials. Consumer surveys were performed in four different countries (Hungary, Germany, France, Sweden) to collect information about the interest and opinion of 877 consumers on (biodegradable) food packaging materials. To carry out the consumer survey in four different countries (France, Hungary, Germany, Sweden) an English template of the questionnaire was developed and translated into the different national languages. The survey was carried out by the combination of paper and internet based methods. The paper based solution was offered for those who had difficulties with the web-based questionnaire. The questionnaires were available online on internet sites. The answers from the interviewees were recorded automatically in excel files. The answers were evaluated for the four countries in total. Data analysis was prepared with Friedman test, and a 5% significance level and 5 % global risk were set.

Packaging specifications were elaborated from all the information collected through the different surveys and analyses for each food product. First a general template for the packaging specifications was developed then all the information was summarized in four different documents for the four specified food products. The proposed specifications will be used by the project partners as the starting point for carrying at the research tasks in the project in a harmonized way. Specifications contain all the main inputs from the surveys and analyses and shall provide precise description of all the essential properties.

3. Results and Discussion

The overall result of the multi-stage, decision supporting approach is the four packaging specifications for the four different food products selected at the beginning of the project. All the management tools are preparative tools for the development of the specifications and they can be considered as partial results.

The above mentioned documents are discussed in detail in the following sections.

3.1 Packaging development brief

A **packaging development brief** template was first developed and filled in by partners for each of the four selected foods, in order to draw first lines of the packaging specifications and consequently of the necessary information/data to be collected from stakeholders.

The general aim of these briefs is to:

- establish the objectives of the development of the packaging materials;
- specify the key acceptance criteria;

- assist the development of a common understanding, create commitment in the team – help dispel assumptions;
- create synergy between different disciplines;
- help to develop ownership for all involved;
- provide an agreed base for further work and a common starting document for modifications as necessary.

In the packaging development brief, the main technical functions to be targeted were described (packaging type, geometry, characteristics, shaping process, labelling, distribution etc.). At this stage, project partners could collect only typical necessary information e.g. on characteristics required for the resin to be transformed into a packaging product, or on the addressed questions concerning potential limitations related to packaging material processing machinery. These aspects needed to be clarified and completed during the later stages of the packaging development. These development briefs also included legal requirements and environmental impacts.

The brief sets the targets for the whole development process. The packaging development brief helped to identify those aspects, for which more detailed technical and consumer surveys were necessary for collecting the basic content of the initial specifications. (R. Shaw, 1996)

The following chapters were stated in the briefs:

- ❖ Chapter 1: Description of the new packaging material
- ❖ Chapter 2: Handling of the foods to be packed
- ❖ Chapter 3: Competitive/benchmarking packaging materials/systems
- ❖ Chapter 4: Target information for new packaging material/system
- ❖ Chapter 5: Minimum quantity for experimental use of the new packaging material
- ❖ Chapter 6: Commercial unit size, distribution of the planned new packaging material/system
- ❖ Chapter 7: Legal requirements for the new packaging material/system
- ❖ Chapter 8: Customer food requirements
- ❖ Chapter 9: Limitations related to packaging material processing machinery
- ❖ Chapter 10: Other limitations
- ❖ Chapter 11: Method of use by the consumer
- ❖ Chapter 12: Deadlines

It is established, that the same expectations for the biodegradability of the packaging solutions were pointed out for all the products: the new packaging systems should be 100% biodegradable by home composting and 100% biosourced. Their production process should be material & energy efficient, and should be based on renewable energy source as far as possible. The packaging development briefs determine a list on the legal requirements and standards that must be considered during the research and development process of the packaging materials. This list contained the same pieces of legislation for each of the four different food products.

3.2 Technical survey

The technical survey was focused on the properties of the packaging materials as determined in the packaging development briefs related to the packaging solutions and covered mostly scientific and technical questions. The survey was carried out on packaging constituents and formulations for each packaging material for the different selected products (1 questionnaire / food product). The main aspects of the technical survey are:

- potential influence of the new packaging solutions on the food, and the ranges of optimal conditions commonly used by the food industry and/or the retailers to extend the shelf-life of the selected food products,
- quality and safety performance indicators of the new packaging solutions and their threshold levels,
- available respiration parameters for respiring products,
- properties of currently used commercial packaging materials, mass transfer properties and geometry,
- retail, distribution and consumption practices. (ITC International Trade Centre, 1998)

Additional information was collected on: 1) availability, volume, properties of by-products, safety concerns, 2) verification of the needs, interest and acceptance of the users packaging materials including regulatory constraints, 3) information on current suppliers of biodegradable materials, additives, bio-packaging solutions and 4) materials characteristics with a focus on processing ability of materials. Potential safety concerns were also considered. (José-María Lagarón, 2011) Needs, interest and acceptance of by-products were verified with stakeholders, including regulatory constraints represented by the European legislation.

An **additional survey** was carried out focusing on the quality and safety aspects of the respiring products exploring the following issues: ranges of optimal gas composition commonly used by the food industry to preserve the selected model food products; quality and safety indicators and their threshold levels of the selected model food products; respiration parameters of the model food products at different temperatures; currently used commercial packaging materials for these products, questions related to the geometry of the model food – packaging systems; retail, distribution and consumption practices: shelf life of the products, typical temperatures & RH% in the supply chain. (ITC International Trade Centre, 1998)

3.3. Consumer survey

The **consumer survey** was focused on the preference of the consumers and their needs related to the biodegradable packaging materials. Thus the consumers' thoughts on the preferences and their shopping habits could be collected.

After the analyses of the results of the survey, it was pointed out that one of the main conclusions is that the respondents in this study are definitely interested in new, environmentally friendly packaging material on which the EcoBioCAP project is aimed. Respondents are aware of the importance of the environmental protection and they are interested in biodegradable packaging materials for the food products selected by the project team (cheeses, fresh products, ready-to-eat meals). However beside the fact that biodegradability is important for the consumers, recyclability and using an eco-friendly procedure are considered more important. Although the respondents who replied to the questionnaire pay attention to the environmental protection aspects they would be willing to pay up to 3% more for packed food products if its packaging is made of a

biodegradable material compared to a packaging made of traditional material. It should be emphasized that this applies only in a very general manner, with absolutely no distinction of consumer or food types.

The main conclusions made on the results of the consumer survey were included into the descriptions of the requirements of the initial specifications.

3.4. Packaging specifications

The main objectives of the **packaging specifications** are to integrate the knowledge of the project partners and all stakeholders, to define the requirements of the packaging materials and to make a clear description of the targeted properties.

Specifications describe a well-structured, clear list of the essential elements with a similar view to the industry scale. These specifications were used as the starting point for carrying the research tasks in the project in a harmonized and targeted way. The specifications were completed for the 4 specified food products with the inputs from the different documents and surveys. At that stage of the research work, specifications contain as many details as possible, but for several values only the acceptability range could be specified. The ranges can be narrowed based on the results of the coming research tasks of the project.

The following main issues were specified in the packaging specifications:

- Key attributes of the model food product, which has to be packed;
- Short descriptions of the type of the package;
- Specific (key) properties of the packaging material:
 - Permeability - mass transfer properties;
 - Draft list of the composition of the raw material of packaging;
 - Dimensions, volume, net weight
 - Physical properties;
 - Storage condition of the packaging material, anticipated shelf life of the empty packaging material (within the characteristic of the packaging material remains stable);
 - Application and sealing properties;
 - Type of packaging machines;
 - References: related legal requirements, standards & testing. (Andrew Bolton, 1997)

The specific values with the defined limits (chemical, microbiological and physical) of the packaging material will enable the project partners to interpret them in a standardized way, will help the identification of the gaps in the information, will allow modification or further improvements where necessary in the advanced phase of the research.

4. Conclusions

Different tools provide the necessary assistance to clarify the first steps of managing the development process of a biodegradable packaging material: what information is necessary, what is available from the project partners, what is available in the literature, what the gaps are and what are the specific issues on which the further research tasks should especially focus. Furthermore, developing a product for the segment of consumers, information about the consumers' need and interest is also essential to be considered during the first stage of the development. All the necessary information has to be collected and the knowledge of the different disciplines represented by the project partners has to be integrated in a logical way for which the packaging specifications can provide good solutions. However, specifications are often used well in the product development processes in the food industry, as the demonstration example shows it is also well applicable in the research projects as well.

To provide a good packaging specification that can be a starting point of the research process, first of all, packaging development briefs should be determined. Furthermore, technical and consumer surveys have to be carried out and have to be analysed precisely to provide proper information for the content of the specification.

This systematic process has already been tested in the EcoBioCAP project that is presented in detail in this article as an example for using the different management tools in a right way with the right content.

5. Glossary

Biodegradation:

Biodegradation is a degradation caused by biological activity especially by enzymatic action, leading to a significant change in chemical structure of a material.

Packaging Development Brief:

A document, where the targets, outcomes of the development activities are specified as a first step before we do any detailed technical/research work of biodegradable packaging solutions. (specifying the main functions only).

Packaging Specification

Packaging specification is a clear establishment of all the packaging material properties that are important for the packaging material manufacturers, food producers and users, consumers and for traders, and clear establishment of all the requirements of the production (quality, food safety, packaging, labelling...) and handling.

Technical survey

Survey to map and analyse the stakeholders' preferences, acceptances and needs, which will help to prepare the specifications for each biodegradable packaging solution.

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