

The background of the entire image is a dark green color. It is decorated with white line art. In the top half, there are several stylized human figures. One figure on the left has its arms raised. Another figure in the center is also with arms raised, holding a small square. To the right, there are more figures, some appearing to be in motion or dancing. Scattered throughout the top half are numerous small, white-outlined squares of various sizes. The bottom half of the image features more stylized figures, including one that looks like a person with a large, rounded head or a hat. There are also more small squares scattered in this section.

ALIBER

LO QUE NADIE VE DONDE TODOS MIRAN

“El proyecto PROGRESO: PROTEÍNAS DEL FUTURO”

Jaume Lluís Tartera

<https://www.mahou-sanmiguel.com/>



PROGRESO

PROTEÍNAS DEL FUTURO: Soluciones innovadoras para el procesamiento de proteínas obtenidas a partir de diversos y nuevos orígenes y su aplicación en nuevos productos alimenticios adaptados a grupos poblacionales con necesidades específicas.

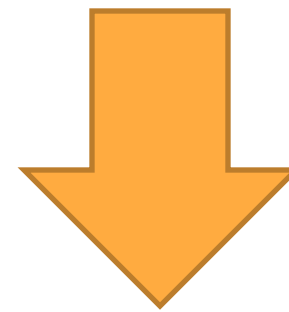
CONTENIDO

- **ANTECEDENTES**
- **CONCEPTO y OBJETIVOS**
- **CONSORCIO**
- **ACTIVIDADES y LOGROS HASTA HOY**
- **Mahou San Miguel**

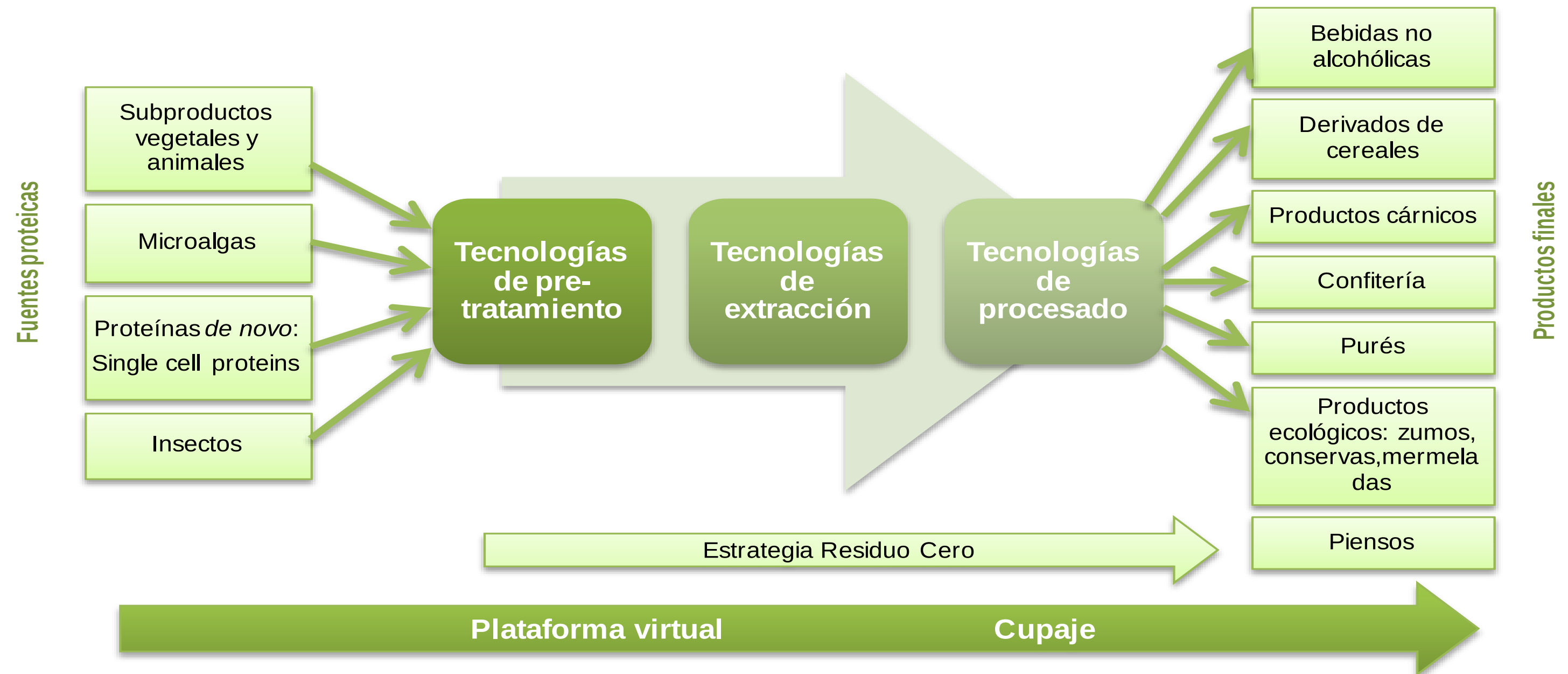
ANTECEDENTES

NECESIDADES DEL SECTOR ALIMENTARIO

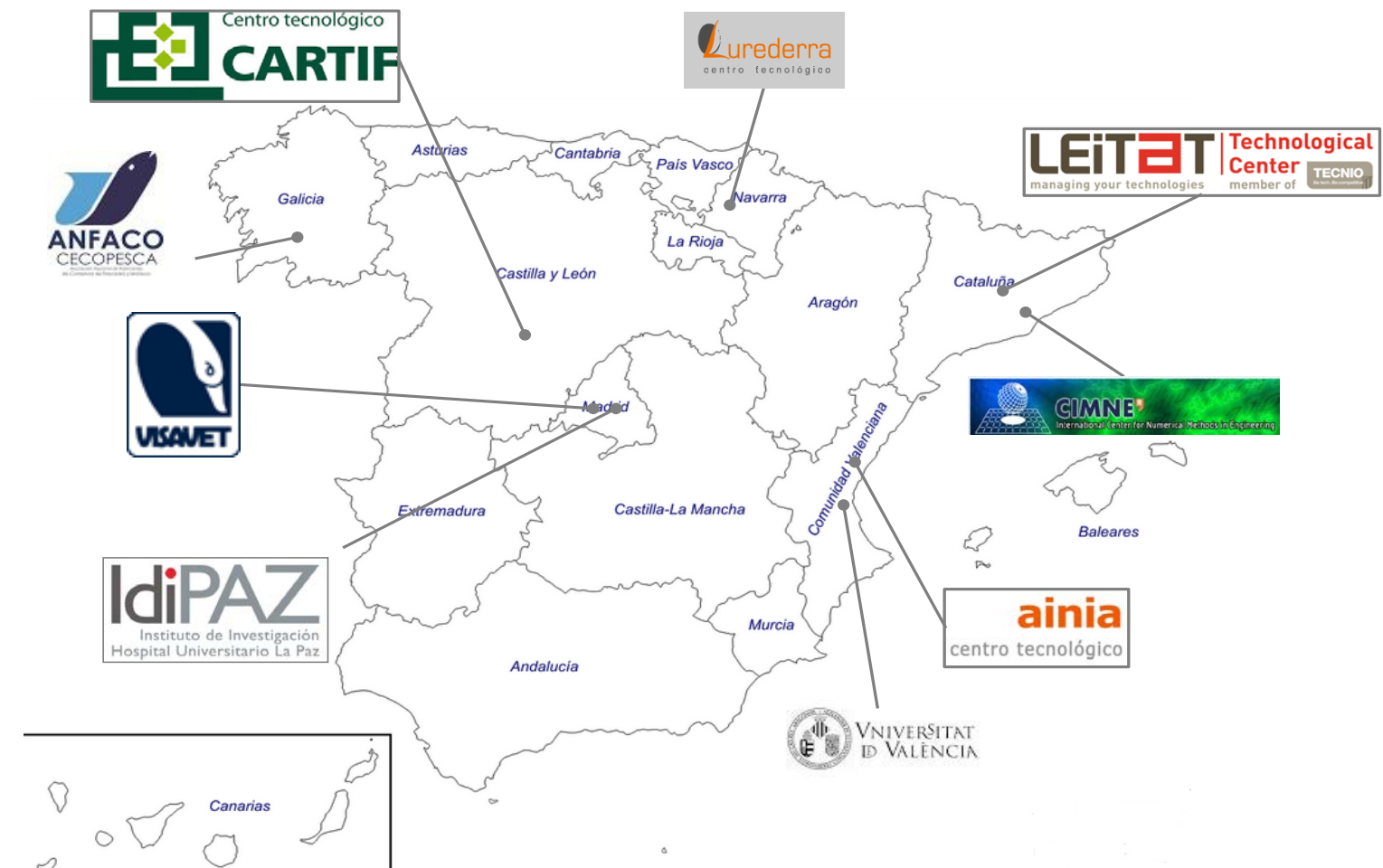
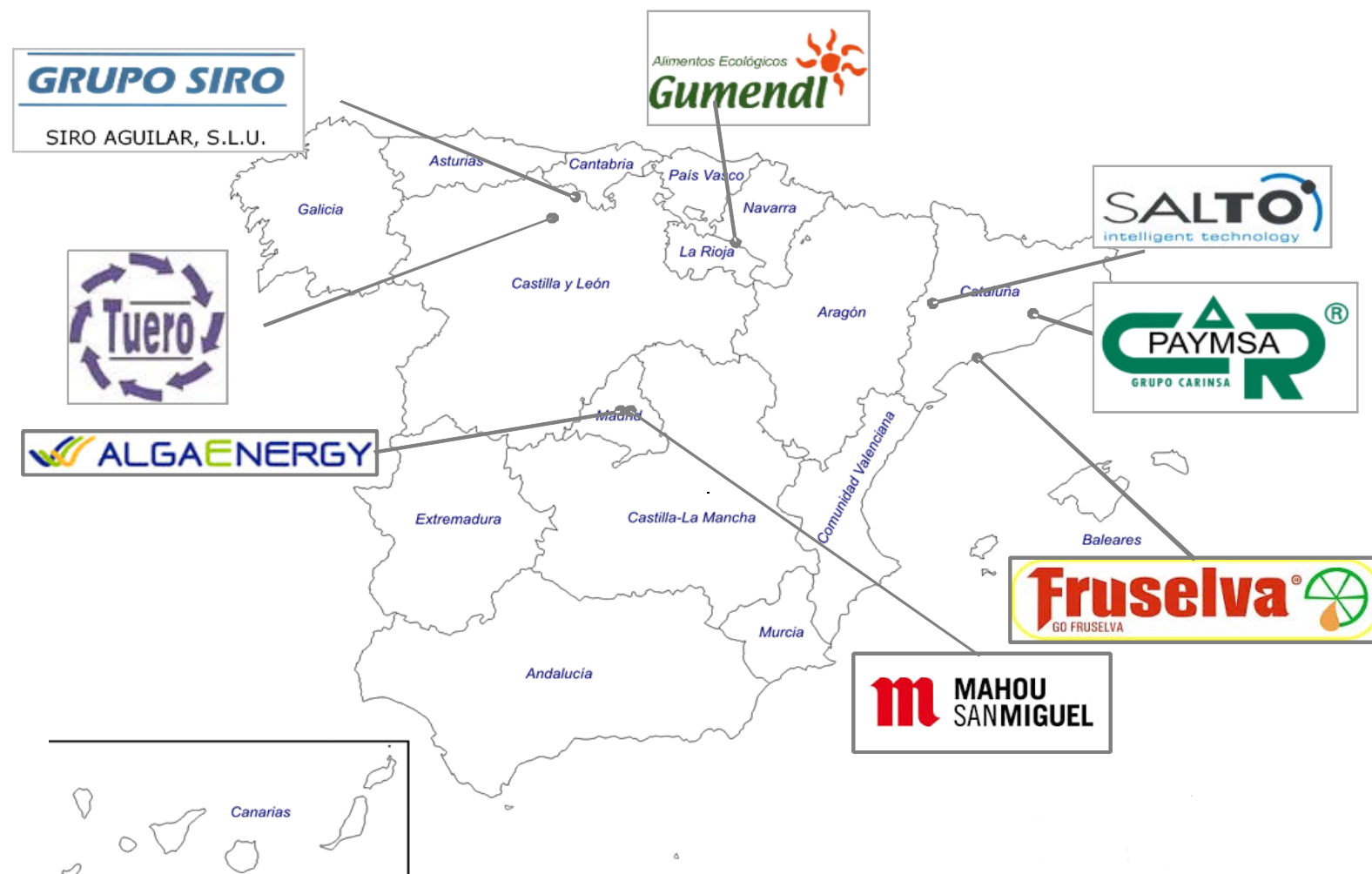
- ✓ Necesidad de incrementar la oferta de productos proteicos
- ✓ Avanzar hacia una economía circular



CONCEPTO



CONSORCIO



ACTIVIDADES



ACTIVIDADES



Actividad 1. Análisis del valor nutricional y composición de cada materia prima



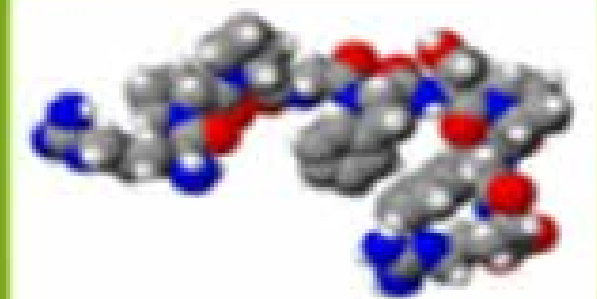
Actividad 3. Análisis de
específicos y desarrollo



ACTIVIDADES



Actividad 2. Investigación en tecnologías de procesado



Actividad 3. Análisis de requisitos específicos y desarrollo TIC

ACTIVIDADES



Actividad 3. Análisis de requerimientos específicos y desarrollo TIC para cupaje

SO

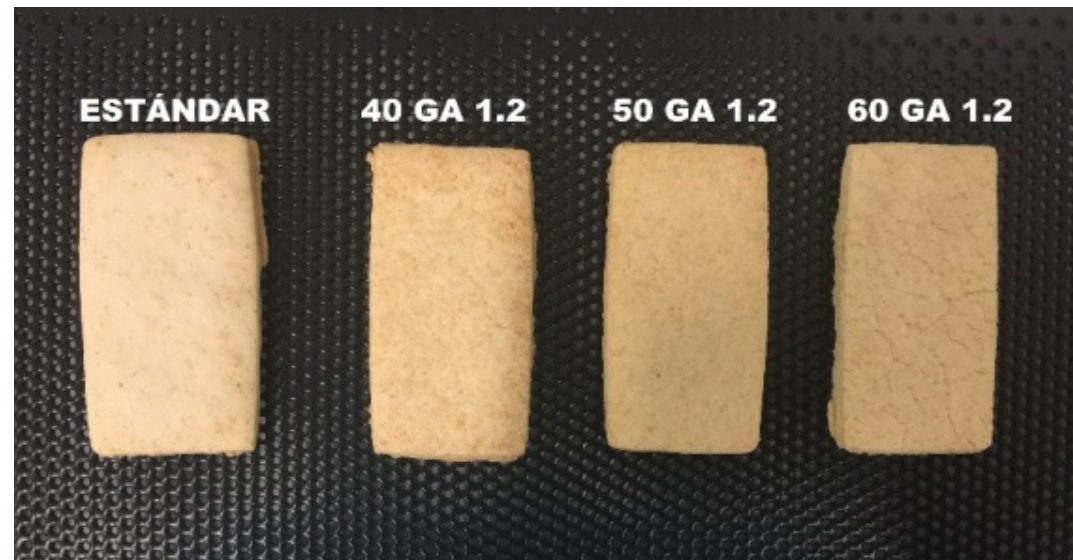
o para el
rollo
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ACTIVIDADES





Primeros prototipos de hamburguesa con harina de insectos.



Prototipos de galletas con harina de leguminosa.



Prototipos de gelatina con concentrado de shiitake.



Zumos con suplemento Aa.



Pruebas de postres lácteos tipo natilla suplementados con proteína de suero y gelatina.



Smoothies con suplemento proteico.

ACTIVIDADES



Combined remediation and protein production using microalgae growth on waste bakery products

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Introduction



Microalgae are a highly diverse and specialized group of microorganisms. The flexibility to switch their nutritional mode based on substrate availability and light condition is one of their multiple advantages. *Chlorella sorokiniana* (Figure 1) is a good example. This microalgae has a great biotechnological potential due to its ability to synthesize products of industrial interest, rapid growth and the ability to adapt to differing nutrient sources in autotrophic, mixotrophic, and even heterotrophic regimes.

Figure 1: *Chlorella sorokiniana*



Figure 2: Waste treatment assay with microalgae

The consideration of microalgae in waste treatment processes offers significant commercial opportunities. However, key aspects such as effluents (source of carbon and nutrients), availability, cultivation system design, productivity of algal culture, nutrient uptake, strain improvement, biomass harvesting and extraction, refining and residual biomass utilization needs further attention.

Results & Discussion

In this work, a concept of utilizing bakery industry waste as a nutrient source for the production of proteins by microalgae growth has been developed. The proposed idea provides an innovative approach to establish a system to valorize bakery industry waste, more specifically, the so-called waste "biscuits flour", and to produce rich protein algal biomass, which could potentially be applied in feed industry.

Biscuit flour (Figure 3a) is based on wheat flour, due to the raw materials from which it comes: a mixture of biscuit, bread, pastry, pasta and, to a lesser extent, snacks. Its composition is shown in Table 1. This sub-product, collected from a Spanish bakery company located in Venta de Baños (Palencia), was used as carbon and nutrients source in mixotrophic growth of *Chlorella sorokiniana*, pure culture supplied by the Spanish Bank of Algae (BEA) (Figure 3b), and in mixotrophic growth of a mixed culture of microalgae, taken from a natural environment (Figure 3c).



Figure 3: a) Biscuits flour, b) Pure culture of *Chlorella sorokiniana*, c) Microalgae mixture growing in a natural media

The feasibility of utilizing bakery waste, raw and hydrolyzed, for algal biomass production was investigated and compared with the growth of the microalgae in WARIS-H medium, prepared according to McFadden and Melkonian (1995).

Table 1: Biscuit flour composition (dry weight calculations)

	Water (%)	Caroten (%)	Asides (%)	Nitrogen (%)	Protein (%)	Starch (%)	Fiber (%)	Sugars (%)
Actual average (SD)	9.51 (0.87)	0.28 (0.26)	3.42 (0.30)	1.82 (0.40)	46.17 (0.87)	49.17 (0.87)	1.02 (0.12)	13.18 (2.81)
Test sample	8.06	-	-	1.72	45.78	-	-	-

Table 2: Culture conditions

Test	B1	B2	B3	B4	B5
Microalgae	<i>C. sorokiniana</i>	<i>C. sorokiniana</i>	Mixed culture	Mixed culture	Mixed culture
Substrate	WARIS-H	Hydrolyzed flour	WARIS-H	Raw flour	Hydrolyzed flour
Total N (mg/L)	-	-	17 mg/L	-	-

The assay consisted in the preparation of 5 batch cultures using 0.5 L sterilized bottles (Figure 4): 2 for the *C. sorokiniana* and 3 for the mixed culture. Then, WARIS-H medium, raw biscuits flour or hydrolyzed biscuits flour were added to the microalgae samples according to Table 2. The amount of flour added to the test B2, B4 and B5 was enough to reach the same Nitrogen concentration than in the test fed with WARIS-H medium. The evolution of the cultures was followed by turbidimetry (HACH 2100N) during 60 days. The turbidity represents a measure of the incident light scattered at right angles from the sample and is positively correlated with the algae growth.

All experiments and analyses were carried out in a laboratory where temperature was maintained at 20±2 °C and the 0.5 L reactors were moderately illuminated by natural light (not ideal conditions for algae growth).



Figure 4: Culture reactors

Conclusions

Preliminary data reveal a good adaptation of the two groups of microalgae under analysis (pure and mix cultures) to the new substrate, although a slightly lower growth rate compared to the samples growing in WARIS-H medium is observed for the mixed culture mainly. Quantification of the protein content in the algal biomass generated is still pending.

The authors gratefully acknowledge support of this work by the Agencia de Innovación, Financiación e Internacionalización Empresarial de Castilla y León (ADEI), project: "Circular Economy in the Agri-Food Sector" and by the Centro para el Desarrollo Tecnológico Industrial (CDTI), project: "CIEN PROGRESO, Proteins of the Future".



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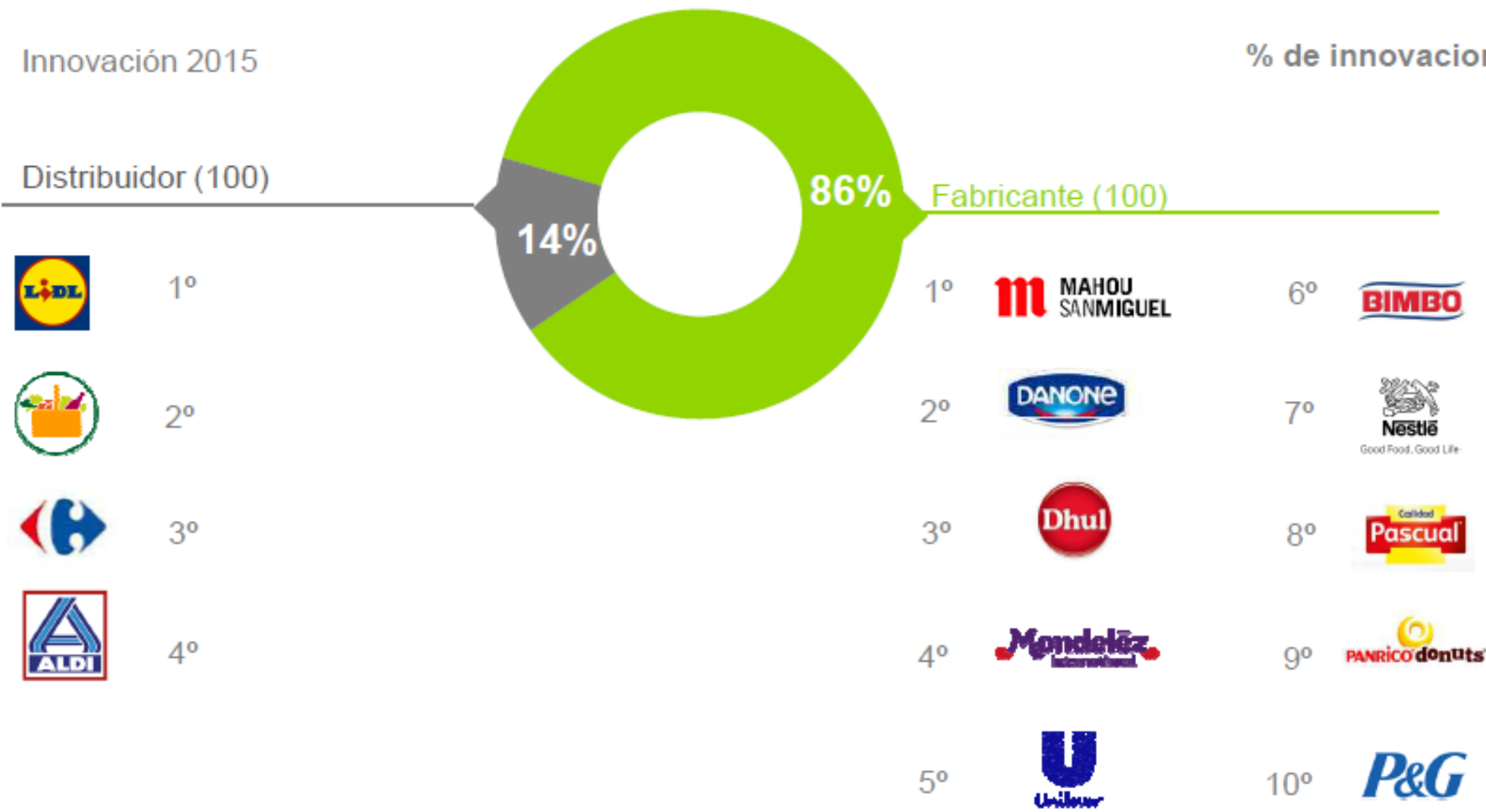


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!Gracias!

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