HÜGAM

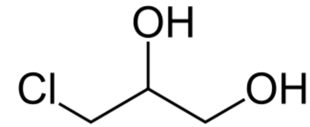
İşlem Bulaşanları

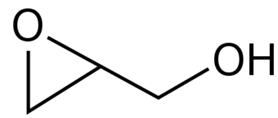
Vural Gökmen

‘işlenmiş’

RAFİNE
YAĞLAR

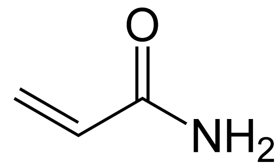
Kloropropanol esterleri
Glisidol esterleri





FIRINCILIK
ÜRÜNLERİ

Akrilamid



Asparajin

Askorbik asit

Linolenik asit

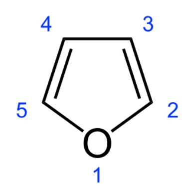
Gliseritler

ÇEREZ
GIDALAR

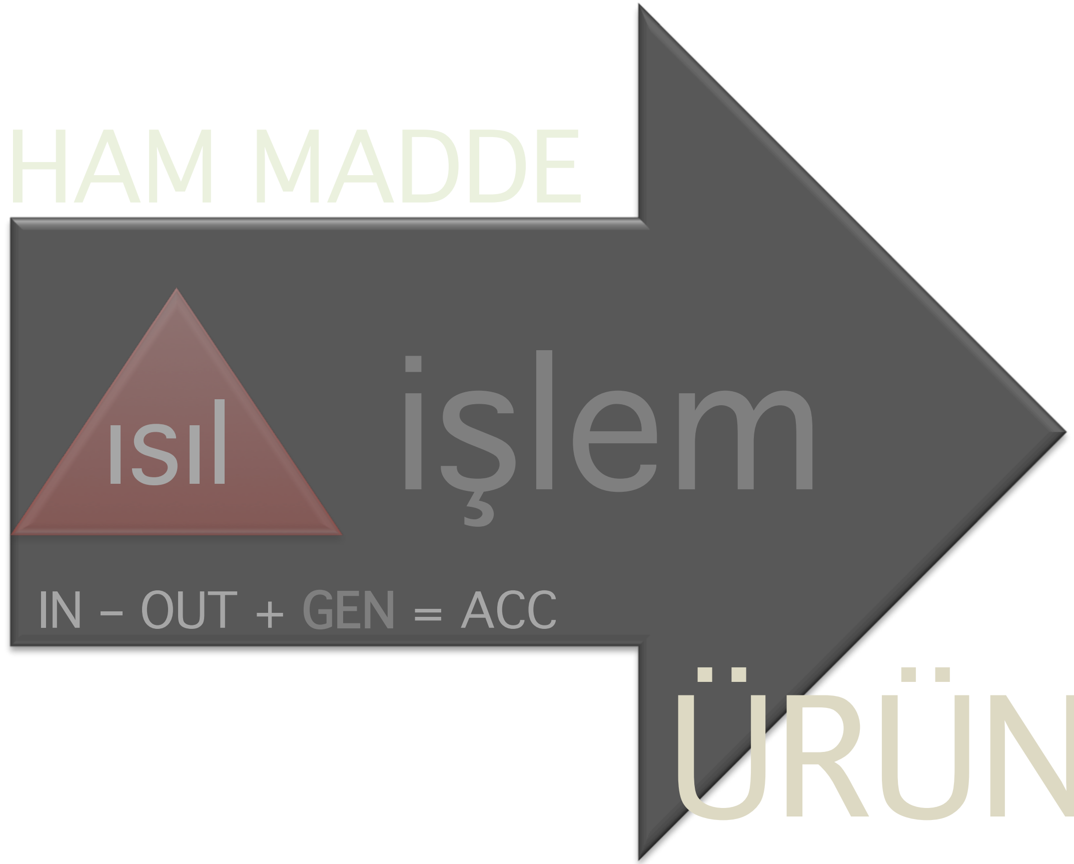
Akrilamid
Furan

BEBE
PÜRELERİ

Furan



İŞLEM BULAŞANLARI



Termal Proses - Kara Kutu

Hammadde /
Formülasyon

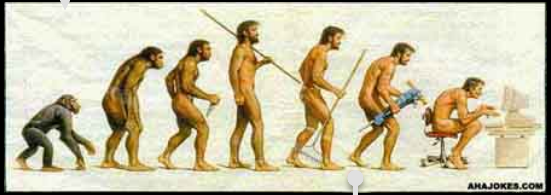
↓

Termal Proses

↓

Ürün

Ateş
1 milyon yıl önce
mağara adamı



Ekmek
MÖ 8 000
gıda mühendisi

Ne öğrendik?

Louise Pasteur (1882-1895)

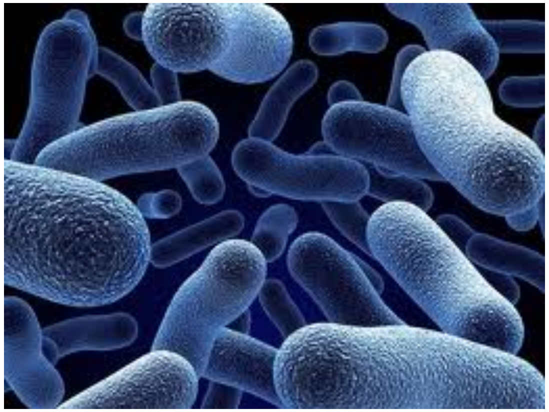
- Kendiliğinden oluş!
- Mikrobiyal bulaşı
  - Termal Yolla Gıda Muhafazası

Gıda Endüstrisine Etkileri

- Modernizasyon
  - Pastörizasyon
  - Sterilizasyon
- Yeni teknolojiler
  - HTST, UHT

konserve

Isıl İşlemin Temelleri



- Termal direnç
  - En dirençli
  - Termal inaktivasyon
- Isı girişimi
  - Soğuk nokta
  - t/T değişimi, F_o değeri, letalite, sterilite

- Stumbo (1973)
  - 57 Tablo (geniş T aralığında z-değerleri)

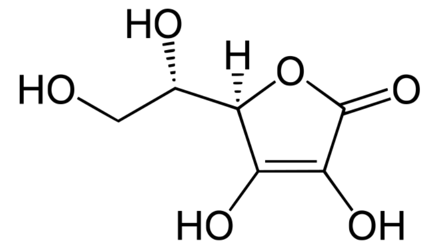
Isıl İşlemin Yan Etkileri

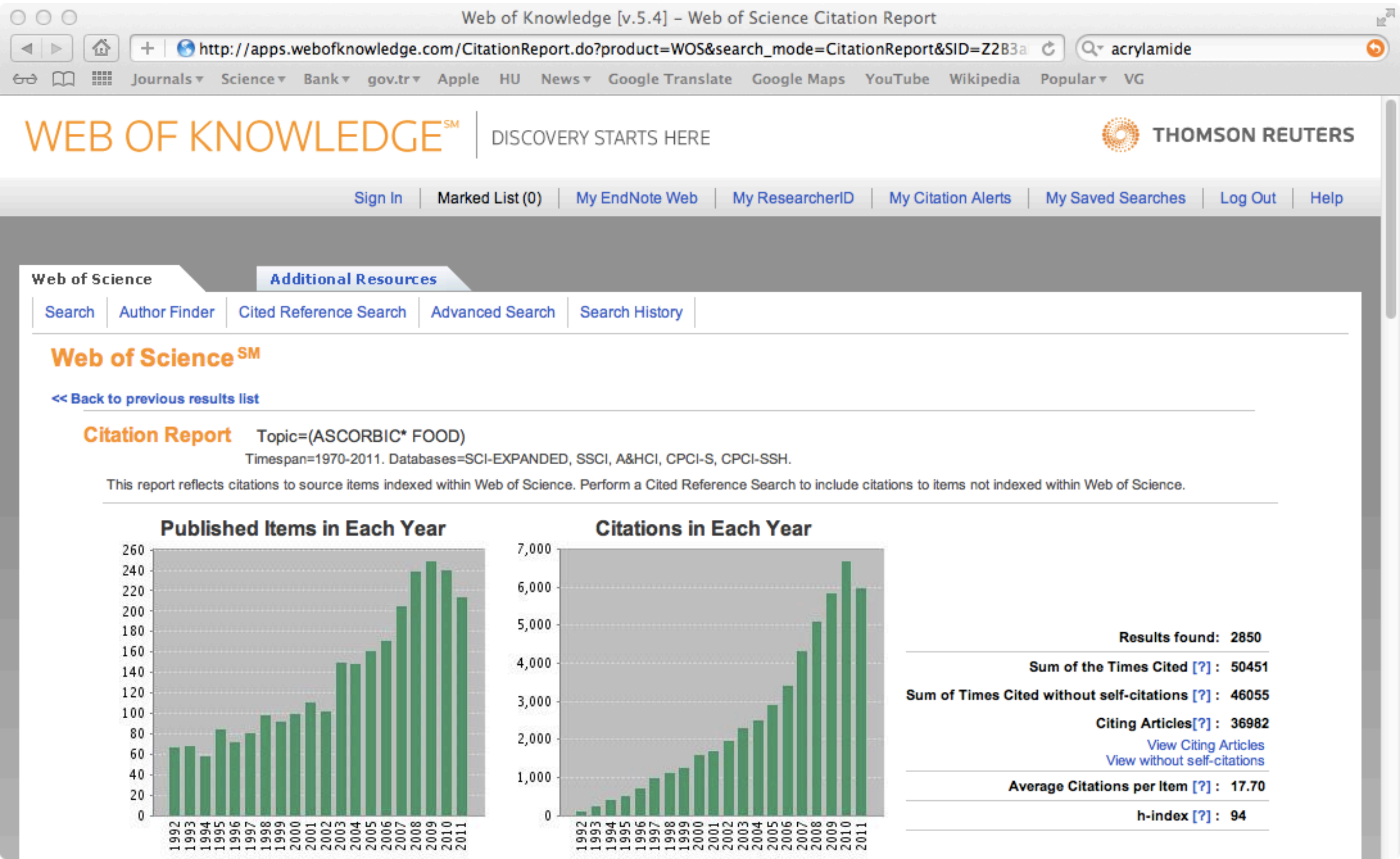
- Besin ögesi kayıpları
  - Vitaminler
  - Amino asitler
  - Lipidler

- m/o inaktivasyonu / besin kaybı
  - D-değeri / C-değeri
  - Fayda / Risk

:. proses başarısı

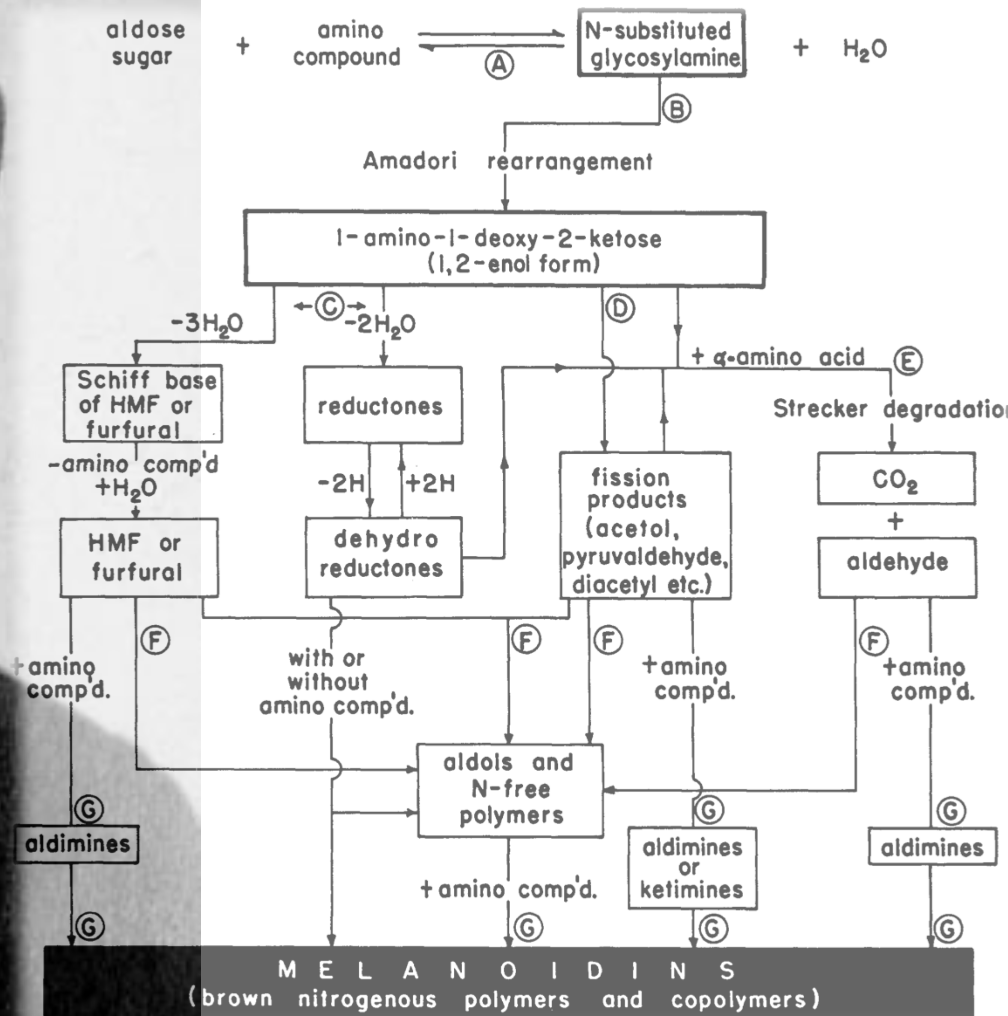
Askorbik asit





MAILLARD REAKSIYONU

Louis Camille Maillard
(1878-1936)



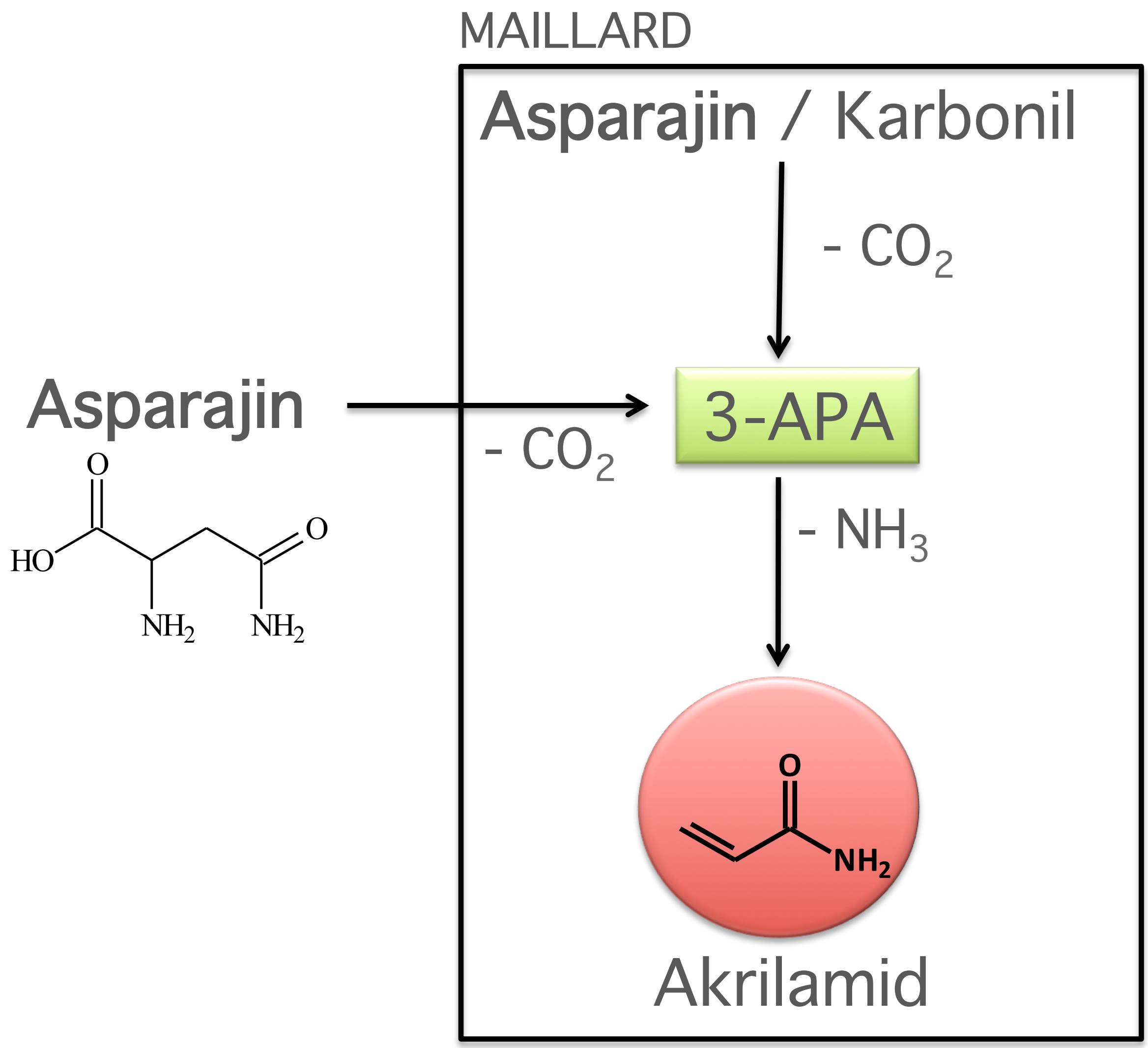
Maillard LC, 1912
Hodge JE, 1953

Maillard Reaksiyonu

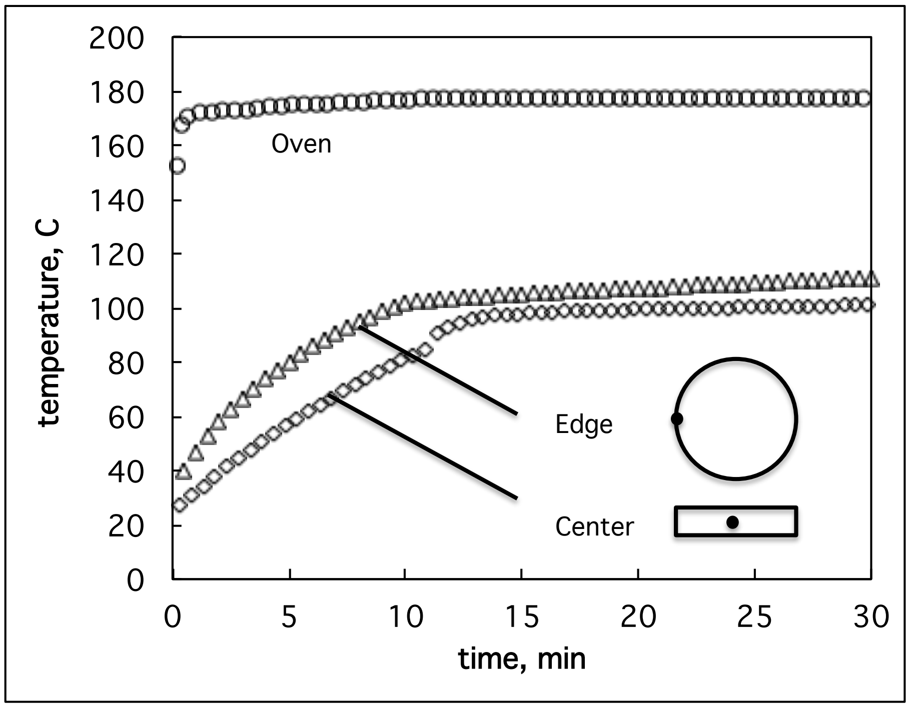
$$\text{Glukoz} + \text{Glisin} \xrightarrow{\Delta\ (>100^{o}C)} \approx 1000\ \text{Ürün}$$

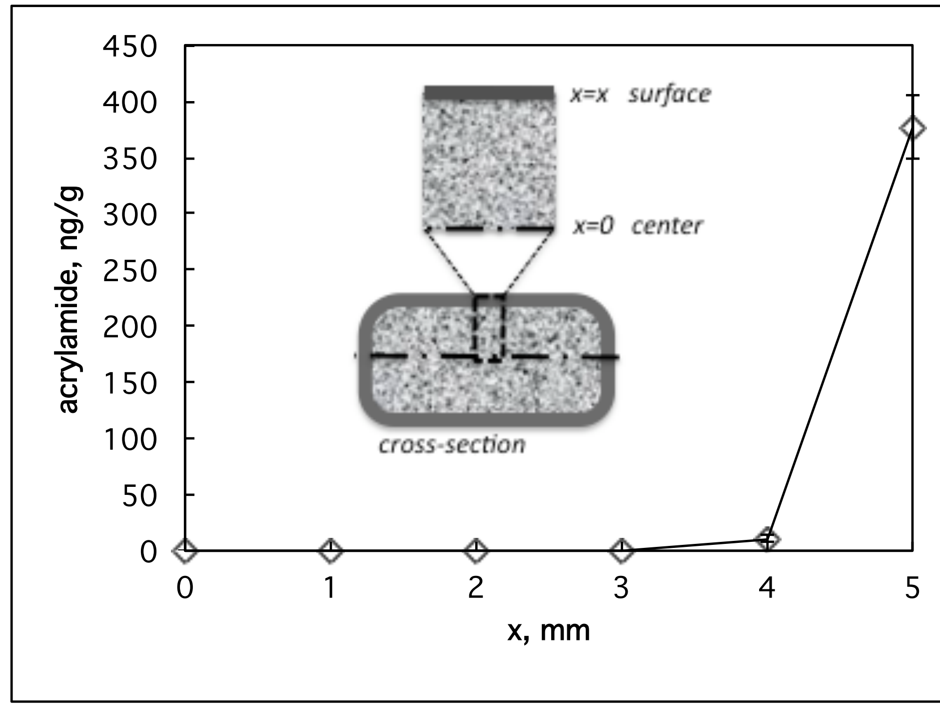
40 kanserojen

Akrilamid Oluşum Mekanizması



t/T - Akrilamid

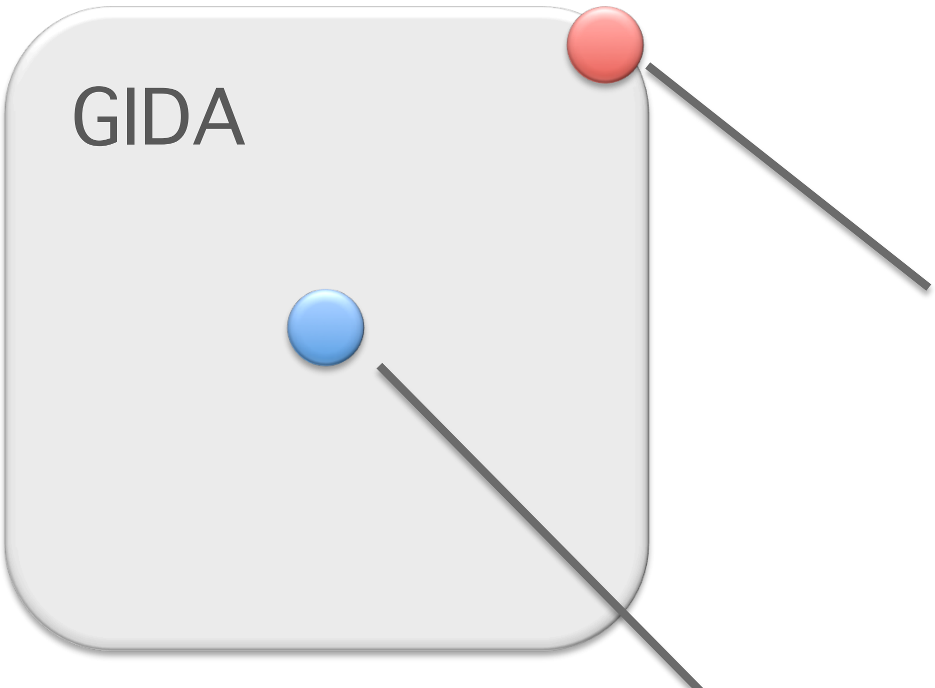




Açar, Ö.Ç., Gökmen, V. (2009) Investigation of acrylamide formation on bakery products using a crust-like model, Molecular Nutrition and Food Research, 53, 1521-1525

Proses hedefleme

< 200 ng/g Akrilamid



$$Risk = t.10^{\left(\frac{T-200}{z}\right)}$$

SICAK NOKTA

$$Letalite = t.10^{\left(\frac{T-121.1}{z}\right)}$$

SOĞUK NOKTA

Proses hedefleme

12 log azalma (*C. botulinum*)

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A new approach to evaluate the risk arising from acrylamide formation in cookies during baking: Total risk calculation

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ABSTRACT

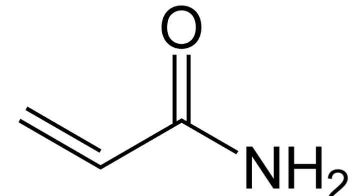
From a food engineering point of view, a viable approach in evaluating the risk related to acrylamide formation in heated foods is still lacking. In this study, thermal process calculation procedure used to evaluate safe levels of microbial inactivation by means of time-temperature history of the product during processing was adapted to evaluate the risk associated with acrylamide formation in cookies during baking. The rate constants were determined in model cookies during baking at different temperatures. For a risk threshold value of 200 ppb of acrylamide, thermal formation times were calculated as 6.29, 0.20 and 0.03 min for 150, 200 and 250 °C, respectively. The *F* and *z* values were determined as 0.20 min and 30 °C, respectively, for acrylamide formation in cookies during baking. Calculated total risk values compared well with experimentally measured acrylamide concentrations of cookies baked under different conditions confirming the success of risk evaluation procedure.

1. Introduction

The discovery of acrylamide in heated foods by Swedish researchers in April 2002 (Tareke et al., 2002) has been considered as an important food-related crisis by international authorities, since acrylamide is a neurotoxin and has been classified as proba-

temperatures well above the ambient boiling point of water in pressurized steam retorts (Simpson et al., 2003). Thermal process calculations, in which process times at specified temperatures are calculated, are performed in order to achieve safe levels of microbial inactivation (lethality) and these calculations should be carefully carried out to ensure public health safety. The first proce-

Akrilamid



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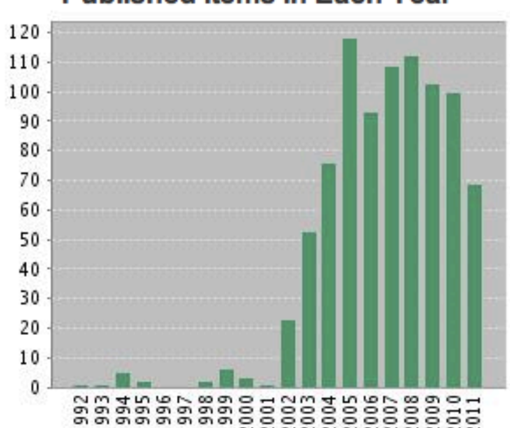

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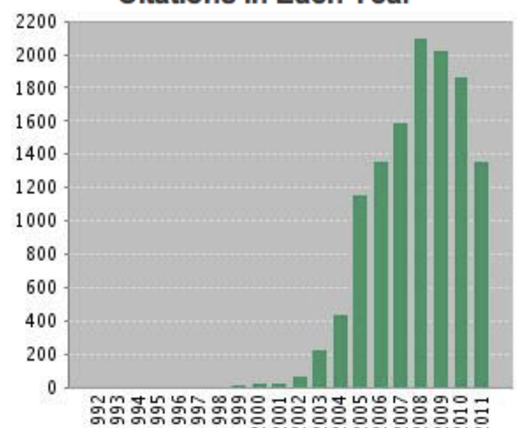

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PROMETHEUS

PROCESSING CONTAMINANTS

Processing contaminants are food-born molecules that are formed during the heat process of foods when temperature reaches high values. Such molecules exhibit in vitro toxic activity, so that mitigation is needed to prevent any possible negative long-term impact on the consumer. PROMETHEUS will investigate the impact of processing on the outbreak of six main neo-formed contaminants: 1 acrylamide, 2 furan, 3 HMF (5-hydroxymethylfurfural), 4 3-MCPD esters, 5 glycidol esters and 6 N -(carboxymethyl) lysine (CML). Four different food models will be studied: infant formula, biscuits, baby food puree and canned fish.

FOUR MITIGATION STRATEGIES

VACUUM BAKING

Applying vacuum during baking contributes to reduce the temperature compared to conventional baking systems. In the project, this technology will be used on biscuits to reducing the possible formation of processing contaminants such as acrylamide and HMF.

CONTACT *Vural Gökmen, Hacettepe University (Turkey)*

HIGH HYDROSTATIC PRESSURE

Using high pressure is another possibility to control the formation of Maillard reaction products. With this technology, the products are introduced in their final package into a vessel and subjected to a high level of isostatic pressure (between 300-600 MPa), transmitted by water. Here again, high pressure allows decreasing the sterilization temperature. The treatment will be tested on baby food puree and canned fish.

CONTACT *Henry Jaeger, Technische Universitat Berlin (Germany)*

OHMIC HEATING

Ohmic heating technology is an innovative thermal technology based on High Temperature Short Time treatment: unlike conventional treatments, ohmic processing heats products internally by passing an electric current through the product, rather than relying on heat transfer from a heated vessel. Ohmic heating will be applied to infant formulas and baby food puree.

CONTACT *Elisabeth Payeux, CTCPA (France)*

INGREDIENT MICROENCAPSULATION

Protecting by microencapsulation the nutrients involved in the formation of processing contaminants is a promising technique to mitigate contamination. The project will investigate the possibility to microencapsulate Vitamin C, iron, polyunsaturated fatty acids (PUFA) and sodium chloride in biscuits and infant formula.

CONTACT *Samira El Mafadi Jian, Capsulae (France) and Vincenzo Fogliano, University of Napoli (Italy)*

	Liquid infant formulas	Biscuits cookies	Fruit and vegetable baby food purees	Processed Fish & Processed vegetables
Vacuum baking				
High pressure treatment				
Ohmic heating				
Microencapsulation				

THREE INNOVATIVE MONITORING STRATEGIES

FRONT FACE FLUORESCENCE ANALYSIS TO MONITOR FOOD PROCESS CONTAMINANTS

Fluorescence spectroscopy is a sensitive analytical technique particularly suitable for monitoring the impact of processing and storage on food quality parameters, especially on heat-derived undesirable compounds: the method is rapid, non-destructive and simple to apply. In the framework of Prometheus, an online sensor will be developed to control the heat charge absorbed by food products and monitor the main heat-influenced quality indicators. Software allowing prediction in real time will also be elaborated for an on-line follow-up of processing contaminant formation.

CONTACT *Inès Birlouez, Spectralys Innovation (France)*

AMBIENT MASS SPECTROMETRY

Direct analysis in real time (DART) is a novel ambient desorption ionization technique. It enables quantification of processing contaminants and their precursors very specifically and with high sensitivity, and it has the possibility to induce thermal changes in the matrix: changes of temperature can be monitored directly on line. In the project, DART mass spectrometry will be used to investigate the reaction intermediates leading to processing contaminant precursors.

CONTACT *Jana Hajslova, VSCHT (Czech Republic)*

COMPUTER VISION BASED IMAGE ANALYSIS

Computer vision-based image analysis can be used as a tool to predict the browning phenomenon associated to food severe heat treatment. This rapid and non-destructive technique will be used to monitor browning of biscuits during baking as well as formation of acrylamide that is strongly correlated with browning.

CONTACT *Vural Gökmen, Hacettepe University (Turkey)*

MODELLING

The data collected in the project will be analysed, and empirical as well as mechanistical models will be developed for a better understanding of the reactions mechanisms leading to the formation of processing contaminants and quantification of the kinetic parameters. Such modelling will make it possible to identify optimal processing parameters and formulation to mitigate process contaminants.

CONTACT *Ine van der Fels-Klerx, RIKILT (The Netherlands)*

ulusal GIDA TEKNOLOJİ PLATFORMU

yaşam için gıda

Gıda Teknoloji Platformu

yaşam için gıda

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1 Ağustos 2011