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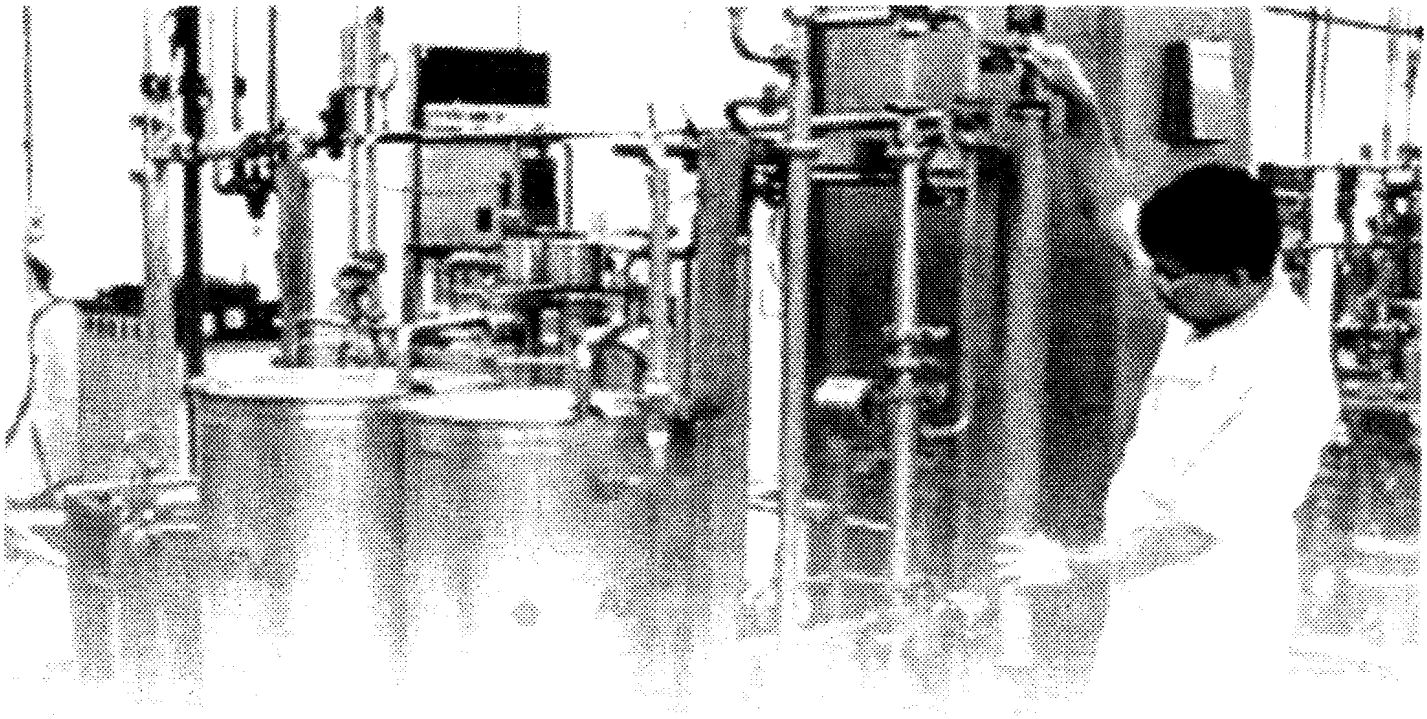
FOOD TECHNOLOGY

AN OVERVIEW OF RECENT TRENDS AND PROCESSES



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INNOVATION IN FOOD TECHNOLOGY :
AN OVERVIEW OF RECENT TRENDS AND PROCESSES

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MAJOR INNOVATIONS IN FOOD TECHNOLOGY (1950-2000) (1)

ENERGY-SAVING MULTIPLE EFFECTS EVAPORATORS

SPRAY-DRYERS + FLUID BED INSTANTISER

CONTINUOUS AGITATED STERILISERS

HTST STERILISERS (INDIRECT HEAT OR STEAM INJECTION/INFUSION)
+ ASEPTIC PACKAGING (also for intermediate packs)

MICROWAVE HEATING, THAWING, DRYING

EXTRUSION-COOKING

DEVELOPMENT OF FLEXIBLE PACKAGES (retort pouch, hot-filled, aseptic pack, tetrapack, vacuum pack, O_2 barrier, multi-layers, multi-compartments, bag-in-box, stand up pouch, easy-open, biodegradable, recyclable...)

WET EXTRACTION PROCESSES (soy proteins)

HEAT-RESISTANT AMYLASES & GLUCOSE ISOMERASE (glucose syrups...)

ARTIFICIAL SWEETENERS (low calorie beverages)

FERMENTATION ON HYDROCARBONS (single cell protein)

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MAJOR INNOVATIONS IN FOOD TECHNOLOGY (1950-2000) (2)

CONTINUOUS MECHANICAL, N_2 & CO_2 FREEZERS (complete frozen meals...)

ULTRAFILTRATION, MICROFILTRATION, REVERSE OSMOSIS ON ORGANIC & CERAMIC MEMBRANES (dairy applications)

CONTINUOUS CHEESE-MAKING, YOGHURT, BREAD, BISCUIT, PASTA LINES...

CLEANING IN PLACE

WATER JET CUTTING

FOOD IRRADIATION

CONTROLLED ATMOSPHERES + SELECTIVE PERMEABILITY FILMS + REFRIGERATION (fruit & vegetables, fresh meat)

FLESH SEPARATORS + CRYOPROTECTANTS (surimi)

CONTINUOUS GELATION & TEXTURISATION (seafood analogues)

IMPROVED YEASTS FOR BAKING OR BREWING; LACTIC ACID STARTER CULTURES

ENZYMATIC TRANS-ESTERIFICATION OF LIPIDS (special margarines)

SUPERCRITICAL CO_2 EXTRACTION

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MAJOR INNOVATIONS IN FOOD TECHNOLOGY (1950-2000) (3)

PRODUCTION OF FOOD INGREDIENTS (protein concentrates, hydrocolloids, fibres, flavours, enzymes...)

SURFACE DECONTAMINATION + CLEAN ROOM TECHNOLOGY + VACUUM PACKAGING + HEAT PASTEURISATION + CHILLED STORAGE (sous-vide, cook-chill, RTE meals)

WASHING + NaOCl DISINFECTION + SLICING + MODIFIED ATMOSPHERES (CO_2) + CHILLED STORAGE (minimal processing of fruits & vegetables)

ULTRA-CLEAN SLICING + MODIFIED ATMOSPHERES (CO_2) (OR HP PROCESSING) + CHILLED STORAGE (pre-sliced ham & cured meats)

MILD PASTEURISATION (OR HP PROCESSING) + CHILLED STORAGE (high quality fruit juices, not from concentrates)

ACTIVE PACKAGING

NON CONTACT IMAGING METHODS

OPTICAL SORTING

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PACKAGING BY TETRA-PAK : A BRIEF SURVEY (after A. BRODY, 2002)

1952: Tetrahedral pack by sealing roll stock material

Aseptic packaging in composite aluminium foil-plastic-paperboard packs: Form-Fill-Seal. HTST & H_2O_2

Tetra Brik

All plastic aseptic packaging

Liquids: milk & juices
Liquids with particulates

Expanded polystyrene packs

New dimensions for delivering foods
Changed consumer food eating behaviour
Achieve consumer-directed functional objectives

Plasma-discharge silica-coating technology (thin film coating)

Barrier plastic bottles for carbonated beverages (seal beer)

Tetra Top : composite-paper-board, brick-shaped carton, topped hermetically (in line) by an injection-moulded plastic lid with easy open and reclosure

Polyester bottles for still beverages; HD-PE bottles for refrigerated still beverages

Smart packaging by radiofrequency identification ⟶ Instant checkout in stores
⟶ Time-power information for heating in microwave oven
⟶ Temperature history information (max. T°C reached)

Packaging for functional foods

Food Service Dept, London

Tetra Recart : retort "carton" (120°C, 2 h) with easy open flap

EXAMPLES OF INNOVATIONS WITH LESSER IMPACT

DRYING

- Improved osmotic drying
- Intermediate moisture foods
- Superheated steam drying
- Jet impingement drying (e.g. of breakfast cereals)
- Freeze-drying

MASS & HEAT TRANSFER ENHANCEMENT

- Ultrasonic cleaning, emulsification, texturisation, extraction…

PRESERVATION & SANITATION

- Ohmic or inductive heating,
- High pressure processing
- HF-assisted freezing & thawing
- HF-homogenisation
- High voltage pulsed electric fields, including
- Cell permeabilisation by PEF
- Intense pulsed light for surface treatment

FREEZING

- Freeze concentration of juices or wine
- Ice nucleating or antifreeze bacteria & proteins
- Ultra low temperature extrusion of ice cream

COATING & ENCAPSULATION

- Fluid bed coating
- Micro-encapsulation for protection & controlled release

SPECIFIC COMMODITY PRODUCTION LINE

- Electrical stimulation & hot boning of fresh meat
- Instant noodle technology (ramen noodles)

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≥ 80% OF THE FOODS CONSUMED IN INDUSTRIAL COUNTRIES UNDERGO TRANSFORMATION OR PRESERVATION PROCESSES

MAJOR FOOD PROCESS INNOVATIONS CAN BE CLASSIFIED AS FOLLOWS:

40% PHYSICAL TECHNIQUES (INCLUDING HEATING)
40% CHEMICAL PROCESSES
20% BIOTECHNOLOGY

50% CONCERN A UNIT OPERATION OR A PRODUCTION LINE
50% ARE RELATED SPECIFICALLY TO A FOOD COMMODITY
(OF WHICH FRUIT & VEGETABLES ≈ 20%, MEAT & FISH ≈ 20%; DAIRY ≈ 15%; CEREALS ≈ 15%)

ONLY ABOUT 1/3 OF THESE INNOVATIONS LEAD TO CLEARLY DIFFERENT CONSUMER PRODUCTS

AMONG THE LESSER IMPACT INNOVATIONS LISTED:

12 PHYSICAL TECHNIQUES
3 CHEMICAL PROCESSES
1 BIOTECHNOLOGY

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FOOD TECHNOLOGIES ISSUED FROM PHYSICS

Radar, electrical heating & lighting → Microwave & HF heating. Ohmic heating. Infra red heating. UV & pulsed white light. Induction heating

Power electronics X Rays → High voltage pulsed electric fields. On line detection of foreign bodies. Shock waves

Nuclear physics & Accelerated electrons → Irradiation

Material sciences (metals, plastics, glass, paperboard, ceramics, alloys) → Food Packaging. Mineral membranes

High pressure processing

Extrusion –cooking

Ultrasounds → Sensors. Mixing. Enhance H_2O transfer. Cleaning technology

Mechanical and separation techniques → Various unit operations :

Size reduction (cutting, grinding, homogenising)
Separation (filtration, sieving, centrifugation)
Recombining (mixing, forming, restructuring)

Thermodynamics, heating, refrigeration & air conditioning techniques → Multiple effects evaporators. Steam injection or infusion. Superheated steam drying or sterilising. Fluid bed instantisers. Clean room technology. Controlled atmospheres

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EXAMPLES OF CHEMICAL FOOD PROCESSES OR ADDITIVES

PRESERVATION

NaCl, sugars, acids, ethanol & other antimicrobial agents (NO_2^-, sorbates, benzoates, propionates, bacteriocins, SO_2, fumigants...)

SOLUBILISATION

- Hydrophobic solvents: hexane, supercritical CO_2, detergents
- Polar solvents: ethanol, isopropanol, alkalis

FAT & OIL MODIFICATIONS

Degumming, neutralisation, hydrogenation, transesterification

C.A. & MODIFIED ATMOSPHERES

CO_2, N_2, O_2, argon

SANITATION

NaOCl, H_2O_2, O_3, acid electrolysed H_2O, lactic acid

CLEANING

Detergents, NaOH, acids

SYNTHETIC FOOD INGREDIENTS/ ADDITIVES

Flavours, vitamins, artificial sweeteners, artificial pigments

OTHER FOOD ADDITIVES

Antioxidants, metal chelators, emulsifying agents, bioactive substances...

STARCH MODIFICATIONS

Reticulation or substitution agents

PROTEIN MODIFICATIONS

Isoelectric precipitants, reticulation or substitution agents

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MAIN CLASSES OF FOOD PRESERVATION PROCESSES

(after G.W. GOULD, 1995)

1. **PREVENT OR RESTRICT THE ACCESS OF MICRO-ORGANISMS TO FOODS**
   - HYGIENE OF RAW MATERIAL; CLEAN ROOMS
   - SURFACE DECONTAMINATION e.g. NaOCl, electrolysed acid water, lactic acid...
   - VARIOUS PACKAGING SYSTEMS
   - MICROFILTRATION, BACTOFUGATION
2. **INACTIVATE MICRO-ORGANISMS PRESENT IN THE FOOD**
   - HEAT PROCESSING (pasteurisation, sterilisation, HTST + aseptic packaging, steam, microwave, IR & ohmic heating)
   - NON THERMAL (irradiation, high pressure, pulsed electric fields, UV light, pulsed magnetic fields, ultrasonics, shock waves)
   - CHEMICAL AGENTS e.g. H_2O_2, NaOCl, O_3
3. **PREVENT OR SLOW DOWN THE GROWTH OF MICRO-ORGANISMS IN FOOD**
   - LOW TEMPERATURE (freezing, refrigeration)
   - LOW A_w (air, freeze, vacuum or osmotic drying, + NaCl, + sugar...)
   - LOW pH (<4.5) (pickling; lactic, acetic or other fermentation)
   - MODIFIED OR CONTROLLED ATMOSPHERES (CO_2, N_2, vacuum)
   - PRESERVATIVES e.g. sorbate, benzoate, ethanol, NO_2^-, bacteriocins, lactoperoxidase, essential oils...

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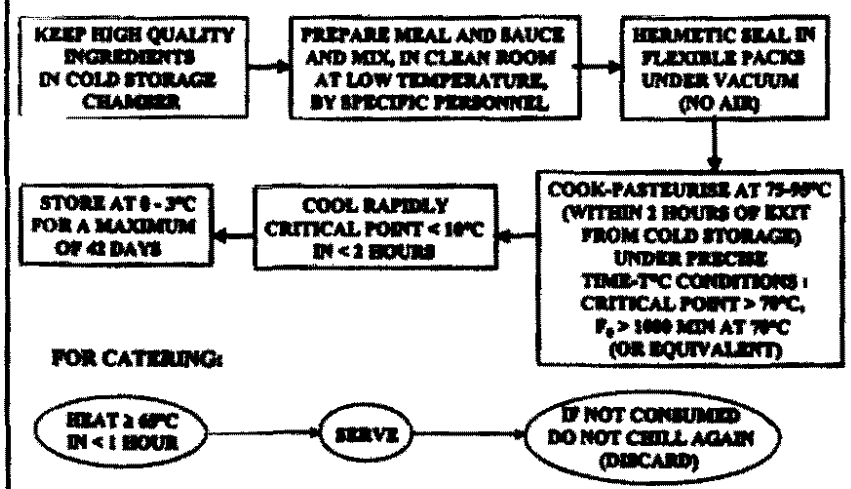
SCHEMATIC LAYOUT OF A COOK-CHILL, SOUS-VIDE, INDUSTRIAL PRODUCTION LINE OF READY TO EAT MEALS



MAIN TRENDS IN FOOD PROCESS INNOVATION (1)

1. ENHANCE SAFETY (microbial & chemical)

USE EFFECTIVE PRESERVATION TECHNOLOGIES
REQUEST SHORT CHILLED STORAGE
INCREASE HYGIENE; HACCP; QUALITY INSURANCE; ISO STANDARDS
PROCESS CONTROL; ON-LINE SENSORS
CLEANING IN PLACE
MICROBIAL OR SHELF LIFE INDICATORS...

2. INCREASE FOOD QUALITY (fresher, more natural)

REDUCE PROCESSING SEVERITY : avoid overheating, use HTST & new ways to deliver heat
USE NON THERMAL OR MINIMAL PROCESSING; reduce salt, sugar, acid, preservatives or additives
USE COMBINATION PROCESSES (HURDLES) to avoid extreme use of a single technology, e.g. cook-chill, or refrigeration + modified atmospheres; naturally-occurring antimicrobials; smart packaging
USE SENSORS e.g. electronic nose, time-temperature integrators
SCALE UP AND ADAPT TRADITIONAL PROCESSES

3. INCREASE CONVENIENCE (ready to eat or to cook, complete meals, microwavable, instant, individual portions, long shelf-life, easy to eat, boil-in-bag, light flexible packaging, informative labelling...)

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MAIN TRENDS IN FOOD PROCESS INNOVATION (2)

4. INCREASE PRODUCTIVITY, REDUCE PRODUCTION COST

Mass production; more uniform; less labour, energy, wastes & pollution
High capacity continuous production lines; automation; on line sensors;
data storage & analysis; water saving; energy recovery

5. FORMULATE & RESTRUCTURE FOODS FROM INDUSTRIAL FOOD INGREDIENTS WITH SPECIFIC FUNCTIONAL PROPERTIES

Mix, blend, bind, shape, form, gel, emulsify, texturise

- BETTER CONTROL OF SHAPE, TEXTURE, CONVENIENCE, COMPOSITION (flavours, pigments, nutrients & bioactive substances)
- ENGINEERED & IMITATION FOODS, FUNCTIONAL & TAILORED FOODS

6. EXTEND NUTRITION TO IMPROVE HEALTH AND PREVENT DISEASES

- Select appropriate plant cultivars & animal species
- Maintain or increase nutrient content and bioavailability during processing & storage
- Fortify with nutrients and produce nutritionally balanced foods
- Reduce contents in salt, sugar, saturated fats, anti-nutrients…
- Enrich in bioactive compounds & ensure stability during processing
- Develop functional foods with validated health claims for specific population groups

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PRINCIPLES & APPLICATIONS OF SELECTED FOOD PROCESSES (1)

PROCESS	BASIC PRINCIPLES	MAIN APPLICATIONS
STEAM INFUSION UHT + ASEPTIC P. LIQUIDS CONTINUOUS	FOOD FLUID JETS (Φ=2.5-4 mm, L=3-3 m) IN STEAM CHAMBER (145-170°C) FOR << 1 SECOND, THEN COOLED BY STEAM FLASH IN VACUUM CHAMBER. ΔT BETWEEN FLUID & STEAM ≤ 6°C	LESS OVERHEATING OF MILK, CREAM, SAUCES, ICE CREAM MIX, INFANT PREPARATIONS, PROCESS CHEESE
OHMIC HEATING HTST + ASEPTIC P. MOIST SOLIDS + LIQUIDS CONTINUOUS	RAPID IN DEPTH ELECTRIC HEATING 50 Hz TO 25 kHz DIPOLE + ION CONDUCTIVITY f [NaCl] OK FOR HIGH CONTENTS OF PARTICULATES	HTST STERILISATION OF LIQUIDS AND LARGE SIZE SOLIDS ⟶ RTE MEALS; HEAT-SENSITIVE FRUITS & VEGETABLES
MICROWAVE HEATING HTST MOIST SOLIDS & LIQUIDS. NON METAL PACKS OK BATCH & CONTINUOUS	RAPID IN DEPTH "DIELECTRIC" HEATING DUE TO DIPOLE (H_2O) OSCILLATION & IONIC CONDUCTIVITY. MORE PENETRATION AT 915 THAN 2450 MHz. GEOMETRIC & CHEMICAL HETEROGENEITY CAUSES NON UNIFORM HEATING.	HEAT, COOK, THAW FOR HOME OR CATERING. FINAL DRYING. TEMPERING. PASTEURISATION OF FRUIT PIECES OR RTE CHILLED MEALS.

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PRINCIPLES & APPLICATIONS OF SELECTED FOOD PROCESSES (2)

PROCESS	BASIC PRINCIPLES	MAIN APPLICATIONS
EXTRUSION -COOKING HTST SEMI-SOLIDS CONTINUOUS	THERMAL (100-220°C) & MECHANICAL. FAST ROTATING SCREWS IN BARREL. 20-30% MOISTURE; SHORT TIME. SHEAR & PRESSURE (30 MPa) IN SPECIAL SCREW SEGMENTS & DIE. BIOPOLYMER CHANGES + EXPANSION	STARCH GELATINIZATION. PRE-COOKED INSTANT MIX. FLAT BREAD, CEREALS. POROUS EXPANDED SNACKS. TEXTURIZED VEG. PROTEINS. PET & FISH FOODS...

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BENEFITS & LIMITATIONS OF SELECTED FOOD PROCESSES (1)

PROCESS	MICROBIAL SAFETY	SENSORIAL & NUTRIT. QUALITY	SHELF-LIFE (T°C)	ADVERSE REACTIONS	ADDITIVES
UHT + aseptic packaging	sterile	0 overheating excellent for liquids (with small particles)	several months 20°C	(enzymatic)	0
OHMIC HEATING + aseptic p.	sterile	excellent also for heat-sensitive pieces (if adequate cooling)	several months 20°C	electrolytic ?	(electrode material ?)
MICROWAVE HEATING	fair (cold spots)	good	variable 4°C	no browning 0	specif. packing. 0
EXTRUSION COOKING	good	some overheating. lysine & vitamin losses. desirable texture changes.	long at 20°C if protected /H_2O & O_2	browning	0

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PRINCIPLES & APPLICATIONS OF SELECTED FOOD PROCESSES (3)

PROCESS	BASIC PRINCIPLES	MAIN APPLICATIONS
HIGH INTENSITY ULTRASOUNDS NON THERMAL LIQUIDS & SOLIDS CONTINUOUS & BATCH	ACOUSTIC WAVES 1-20 W/cm², 20-100 KHz FORM COMPRESSION & DEPRESSION ZONES IN SAMPLES. DISSOLVED GASES (AIR) FORM FAST EXPANDING-IMPLODING SMALL GAS BUBBLES = "CAVITATION". → HIGH LOCAL T°C, P & SHEAR GRADIENTS. SHOCK WAVES HAVE MECH. & CATALYTIC EFFECTS	IMPROVED MASS TRANSFER (DRYING, FILTRATION, FLOW, DISPERSION, NUCLEATION, SURFACE CLEANING, CELL BREAKDOWN & EXTRACTION)
MICROFILTRATION NON THERMAL FLUIDS CONTINUOUS	FRACTIONATION ON POROUS GRAPHITE or Al_2O_3 MEMBRANE WITH ACTIVE Zr or Ti OXIDE FILM and 0.1 to 1.5 µm PORES. HEAT & ACID RESISTANT. TANGENTIAL FLOW (~ 1 BAR)	• HIGH MICROBIAL REDUCTION OF SKIM MILK AT ~ 60° ⟶ EXTENDED SHELF LIFE AT 4°C. • SEPARATION OF "NATIVE" CASEIN MICELLES & SERUM PROTEIN CONCENTRATES

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PRINCIPLES & APPLICATIONS OF SELECTED FOOD PROCESSES (4)

PROCESS	BASIC PRINCIPLES	MAIN APPLICATIONS
IRRADIATION NON THERMAL SOLIDS. ALL PACKS OK BATCH & CONTINUOUS	γ RAYS OR ACCELERATED ELECTRONS EJECT PERIPHERAL ELECTRONS ⟶ MOLECULAR IONISATION. EFFECTIVE ON MOIST, FROZEN & DRY FOODS. MINOR CHANGES IN FOOD CONSTITUENTS ≤ 10 kGy	INACTIVATION OF INSECTS, PARASITES, MICROORGANISMS (VEGETATIVE CELLS ≤ 10 kGy) & SOME METABOLIC PLANT PROCESSES (GERMINATION...). ⟶ SANITATION OF MEATS, SPICES TROPICAL FRUITS, EGG Pr...

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PRINCIPLES & APPLICATIONS OF SELECTED FOOD PROCESSES (5)

PROCESS	BASIC PRINCIPLES	MAIN APPLICATIONS
HIGH HYDROSTATIC PRESSURE NON THERMAL ± HEAT SOLIDS IN FLEXIBLE PACKS & LIQUIDS BATCH & SEMI-CONTINUOUS	100-800 MPa, 2-30 MIN, -20 TO 110°C. PRESSURE ENHANCES REACTIONS, PHASE & CONFORMATION CHANGES WITH $\Delta V < 0$. UNIFORM PRESSURE THROUGHOUT FOOD → SAME TREATMENT TIME FOR DIFFERENT SAMPLE SIZES. SMALL COMPRESSION ENERGY. CHANGES IN BIOPOLYMERS. SMALL MOLECULES LESS AFFECTED	• MICROBIAL INACTIVATION OF VEGETATIVE CELLS (SPORES AT HIGHER T°C) → SANITATION + LONGER CHILLED SHELF LIFE. (FRUIT PIECES, JUICES, PUREES, CURED MEATS...) (HTST STERILISATION) • PROTEIN TEXTURISATION • HP-FREEZING & THAWING
HIGH VOLTAGE PULSED ELECTRIC FIELDS NON THERMAL FLUIDS CONTINUOUS	10-80 kV/cm, μs PULSES ELECTROPORATION OF CELL MEMBRANES: → MICROBIAL INACTIVATION. → CELL PERMEABILISATION	• PASTEURISATION OF HOMOGENEOUS FLOWABLE LOW CONDUCTIVITY FLUIDS: FRUIT JUICES & PUREES, WINE MILK, LIQUID EGG, SAUCES • CELL & TISSUE EXTRACTION OF ENZYMES OR METABOLITES

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BENEFITS & LIMITATIONS OF SELECTED FOOD PROCESSES (2)

PROCESS	MICROBIAL SAFETY	SENSORIAL & NUTRIT. QUALITY	SHELF-LIFE (T°C)	ADVERSE REACTIONS	ADDITIVES
IRRADIATION (≤10 kGy) + mild heat	good 0 insect or parasite	excellent	short to long ≤4°C	enzymatic ? ± lipid oxidation ± free radicals ?	Less than alternative processes
HIGH PRESSURE (5-50°C)	inactivation of vegetative cells. no inactivation of bact. spores	fresh-like except for texture changes	variable ≤4°C longer at pH≤4	enzymatic. oxidations ?	(specif. packag.) 0
PULSED ELECTRIC FIELDS (20-50°C)	inactivation of vegetative cells. no inactivation of bact. spores	fresh-like	variable ≤4°C longer at pH≤4	no electrolysis. enzymatic. oxidations ?	0

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BENEFITS & LIMITATIONS OF SELECTED FOOD PROCESSES (3)

PROCESS	MICROBIAL SAFETY	SENSORIAL & NUTRIT. QUALITY	SHELF-LIFE (T°C)	ADVERSE REACTIONS	ADDITIVES
CONTROLLED ATMOSPHERE + refrigeration	fair to good	fresh to fair	short to long ≤4°C	metabolic, enzymatic	$CO_2/N_2/O_2$ + relative humidity
MINIMAL PROCESSING + CO_2 + refrigeration	fair	fresh to fair	short ≤4°C	enzymatic	traces NaOCl CO_2 (lactic acid, bacteriocins)
COOK & CHILL + sous vide	good if kept ≤ 3°C	excellent	max 42 days 0-3°C	0	0

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EUROPEAN PATENT OFFICE (2001)

EUROPEAN APPLICATIONS FILED + EURO-PCT APPLICATIONS ENTERING THE REGIONAL PHASE IN 2001

CLASSES A21-A24: FOODSTUFFS AND TOBACCO

COUNTRY OF ORIGIN OF APPLICANTS:

CH	DE	FR	GB	IT	NL	JP	US	
123	157	68	76	51	151	84	258	(In 2001)
112	94	42	85	42	131	80	185	(In 1997)

AT	BE	DK	ES	FI	GR	IE	LU	PT	SE	OTHER	TOTAL
7	12	36	14	7	1	4	2	0	12	76	1,139

THESE 1,139 PATENT APPLICATIONS FOR FOODSTUFFS AND TOBACCO REPRESENT 1.04% OF TOTAL PATENT APPLICATIONS (110,025 IN 2001).

A TOTAL OF 34,704 EUROPEAN PATENTS WERE DELIVERED IN 2001, WITH AN AVERAGE OF 7.68 COUNTRIES DESIGNED PER PATENT.

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SOME CARACTERISTICS OF THE FOOD INDUSTRY (2001)

	INCOME (BILLION €)	PERSONNEL	NB OF UNITS	R&D PERSONNEL
Σ FRENCH FOOD FIRMS	131	300,000	4,300 FIRMS (≥ 10 PERSONS)	
NESTLE	50	230,000	460 PLANTS IN 84 COUNTRIES	3,500
UNILEVER	50	300,000	500 OPER. Co. IN 90 COUNTRIES	8,500

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INTERNATIONAL FOOD PROCESS EXHIBIT (IPA, PARIS, Nov. 2002)
INNOVATION AWARDS (1)

OSMOFOOD (ADIV) (F)

CONTINUOUS PREPARATION OF SEMI-DRIED FILMS FROM MINCED MEAT

⟶ RECONSTITUTED SLICED HAM...

COEX SKIN (SONJAL) (F)

CONTINUOUS CO-EXTRUSION OF VEGETABLE (ALGINATE) CASING FOR MEAT PRODUCTS

⟶ ENCASING OF 300 TO 600 kg SAUSAGE PER HOUR

PEELER-CORER-CUTTER CS600 (KRONEN) (D)

ADJUSTABLE ROTATING KNIVES FOR FRUIT PROCESSING (600/ hour)

⟶ CHUNKS, SLICES OF VARIOUS SIZES & THICKNESS

HIGH FREQUENCY OHMIC HEATER (EMMEPIEMME) (I)

25 kHz, 3 kV, INSULATING FIBER GLASS COLUMNS,
STAINLESS STEEL RING ELECTRODES (10 cm section), n • 600 kW
⟶ PASTEURISATION OF WHOLE PEACHES OR TOMATOES IN ~ 1 MIN
no corrosion, fast heating

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INTERNATIONAL FOOD PROCESS EXHIBIT (IPA, PARIS, Nov. 2002)

INNOVATION AWARDS (2)

PRESS PACK (EGETIER) (F)
HYGIENIC PRESSING OF INCOMPLETELY FILLED PACKS
→ SEPARATE RECOVERY OF LIQUIDS AND OF PRESSED PACKS
(milk, yoghurts, fruit juices)

CATALLIX (TMI EUROPE) (F)
IMMOBILISED LACTOPEROXIDASE (+ $OSCN^-$) → ACTIVATED WATER
FOR SANITATION OF CUT FRUIT AND VEGETABLES

FLUOLASER SORTING TECHNOLOGY (BARCO MACHINE VISION) (NL)
ON LINE SORTING OF GREEN VEGETABLES: UP TO 16 T/ HOUR
Detects chlorophyll with high accuracy. Eliminates foreign bodies

EWD 2002 (SYSTELIA) (F)
EARLY WARNING DIAGNOSIS OF CEREALS
ACOUSTIC DETECTION OF ≥ 50 INSECTS (LARVAE + ADULTS) PER m^3

GENE DISC CYCLER (GENE SYSTEMS) (F)
DNA ANALYSER BY PCR → FAST DETECTION OF PATHOGENIC FLORA

DNA CHIP (BIOMERIEUX) (F)
RAPID DETERMINATION OF ANIMAL SPECIES IN FOODS BY HYBRIDISATION

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CONCLUSIONS

- DURING THE LAST 50 YEARS, THE FOOD INDUSTRY HAS SUCCESSFULLY INVENTED OR ADAPTED A RANGE OF MAJOR PROCESS INNOVATIONS
- MANY LESS UTILISED PROCESS INNOVATIONS ARE ALSO AVAILABLE
- FOOD PROCESSES ISSUED FROM PHYSICS PREDOMINATE
- FOOD PRESERVATION PROCESSES HAVE PLAYED A MAJOR ROLE IN THE MASS PRODUCTION OF FOOD PRODUCTS
- THE MAIN TRENDS FOR FOOD PROCESS INNOVATION ARE: SAFETY, STABILITY, SENSORIAL QUALITY, CONVENIENCE, PRODUCTIVITY, FORMULATION FROM INDIVIDUAL INGREDIENTS, AND HEALTH BENEFITS
- ALL PROCESSES HAVE BENEFITS AND LIMITATIONS, BUT NEW PROCESSES SHOULD BE CAREFULLY CHECKED FOR CHEMICAL CHANGES IN FOOD CONSTITUENTS, PRESERVATION OF DEMONSTRATED & DESIRABLE BIOACTIVE SUBSTANCES, & ABILITY TO COMPLY WITH GMP
- OTHER CHALLENGES FOR NEW PROCESSES INCLUDE: R & D, TEACHING, CONSUMER INFORMATION, ENVIRONMENTAL CONCERN, ADAPTATION TO DEVELOPING COUNTRIES
- PATENTS, R&D ACTIVITIES, EQUIPMENT EXHIBITIONS & LISTS OF AWARDS PROVIDE SOME INSIGHTS ON FUTURE FOOD TECHNOLOGIES

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