Attachment 63a

Case No.: IPR2023-00208
U.S. Patent No. 11,013,250

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Investigation of the boiled potato flavor by human sensory and instrumental methods

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American Journal of Potato Research **77**, 111–117 (2000) | Cite this article

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Abstract

The flavor of boiled potatoes was investigated using sensory and instrumental methods to get basic information concerning sensory features and aroma compounds for use in breeding research and quality control. The sensory odor profiles of three genotypes were found to differ especially in negative sensations like “burnt”, “fodder” and “musty”. The aroma volatiles were isolated by a modified simultaneous steam distillation and extraction method. Nineteen character impact compounds of boiled potato aroma were pointed out by gas chromatography with nitrogen specific detection, gas chromatography —mass spectrometry and gas chromatography —olfactometry. The comparison of the quantified odor impressions in three genotypes by chromatography —olfactometry revealed the substances responsible for the typical boiled potato odorants and off-flavor notes.

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Additional Key Words

Cooked potato **potato flavor** **potato aroma** **human sensory** **quantitative descriptive analysis** **gas chromatography** **gas chromatography olfactometry** **character impact compounds**

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Attachment 63b

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362    1#$aBegan with v. 75, no. 1 (Jan. 1998).
500    ##$aRefereed/Peer-reviewed
550    ##$a"An official publication of the Potato Association of
America."
588    ##$aDescription based on: Vol. 75, no. 1 (Jan. 1998); title
from pdf image of article (SpringerLink, viewed Nov. 14, 2011).
588    ##$aLatest issue consulted: Vol. 92, no. 5 (Oct. 2015)
(viewed Nov. 10, 2015).
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Attachment 63c

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053 _0 |**a** SB211.P8 |**c** Culture
053 _0 |**a** TP444.P6 |**c** Food processing
150 __ |**a** Potatoes
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450 __ |**a** Solanum tuberosum
450 __ |**a** White potatoes
550 __ |**w** g |**a** Solanum
906 __ |**t** 9107 |**u** fk05 |**v** 1
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985 __ |**e** GAP

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BLAST Basic Local Alignment Search Tool

BLAST finds regions of similarity between biological sequences. more...

The Basic Local Alignment Search Tool (BLAST) finds regions of local similarity between sequences. The program compares nucleotide or protein sequences to sequence databases and calculates the statistical significance of matches. BLAST can be used to infer functional and evolutionary relationships between sequences as well as help identify members of gene families.
Learn more about how to use the new BLAST design

BLAST Assembled Genomes

Choose a species genome to search, or list all genomic BLAST databases.

- Human
- Mouse
- Rat
- *Arabidopsis thaliana*

- *Oryza sativa*
- *Bos taurus*
- *Danio rerio*
- *Drosophila melanogaster*

- *Gallus gallus*
- *Pan troglodytes*
- *Microbes*
- *Apis mellifera*

Basic BLAST

Choose a BLAST program to run.

nucleotide blast	Search a **nucleotide** database using a **nucleotide** query *Algorithms:* blastn, megablast, discontiguous megablast
protein blast	Search **protein** database using a **protein** query *Algorithms:* blastp, psi-blast, phi-blast
blastx	Search **protein** database using a **translated nucleotide** query
tblastn	Search **translated nucleotide** database using a **protein** query
tblastx	Search **translated nucleotide** database using a **translated nucleotide** query

Specialized BLAST

Choose a type of specialized search (or database name in parentheses.)

- Make specific primers with Primer-BLAST
- Search trace archives
- Find conserved domains in your sequence (cds)
- Find sequences with similar conserved domain architecture (cdart)

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- Search sequences that have gene expression profiles (GEO)
- Search immunoglobulins (IgBLAST)
- Search for SNPs (snp)
- Screen sequence for vector contamination (vecscreen)
- Align two sequences using BLAST (bl2seq)
- Search protein or nucleotide targets in PubChem BioAssay

Your Recent Results New!

All Recent results...

News

Find specific primers with Primer-BLAST!

Primer-BLAST combines primer design (using Primer3) and a specificity check with BLAST.
2008-07-22 09:26:51

More BLAST news...

Tip of the Day

Using Tree View to Examine Relationships Between Sequences.

The new Tree View option on the NCBI Web BLAST service presents a dendrogram or tree display that clusters sequences according to their distances from the query sequence. This display is helpful for recognizing the presence of aberrant or unusual sequences or potentially natural groupings of related sequences such as members of a gene families or homologs from other species in the BLAST output.

More tips...

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Codes Used in Sequence Description

Nucleotide

Nucleotide Base Codes

The nucleotide base codes that are used with the International Nucleotide Sequence Database is as follows.

Sequence data is expressed with small letters only. Capital letter will be automatically converted to small letter.

Symbol	Meaning	Explanation
a	a	adenine
c	c	cytosine
g	g	guanine
t	t	thymine in DNA; uracil in RNA
m	a or c	amino
r	a or g	purine
w	a or t	
s	c or g	
y	c or t	pyrimidine
k	g or t	keto
v	a or c or g	not t
h	a or c or t	not g
d	a or g or t	not c
b	c or g or t	not a
n	a or c or g or t	any

[References]

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- Cornish-Bowden, A. Nucl Acid Res 13, 3021-3030 (1985)
- Feature Table Definition: 7.4.1 Nucleotide base codes (IUPAC)

Modified Base Abbreviations

An example for description of the modified base in FEATURES line.

Example

```
     FEATURES             Location/Qualifiers
          modified_base   15
                          /mod_base="m2g"
```

Abbreviation	Modified base description
ac4c	4-acetylcytidine
chm5u	5-(carboxyhydroxylmethyl)uridine
cm	2'-O-methylcytidine
cmnm5s2u	5-carboxymethylaminomethyl-2-thiouridine
cmnm5u	5-carboxymethylaminomethyluridine
dhu	dihydrouridine
fm	2'-O-methylpseudouridine
gal q	beta,D-galactosylqueuosine
gm	2'-O-methylguanosine
i	inosine
i6a	N6-isopentenyladenosine
m1a	1-methyladenosine
m1f	1-methylpseudouridine
m1g	1-methylguanosine
m1i	1-methylinosine
m22g	2,2-dimethylguanosine
m2a	2-methyladenosine
m2g	2-methylguanosine

Abbreviation	Modified base description
m3c	3-methylcytidine
m4c	N4-methylcytosine
m5c	5-methylcytidine
m6a	N6-methyladenosine
m7g	7-methylguanosine
mam5u	5-methylaminomethyluridine
mam5s2u	5-methoxyaminomethyl-2-thiouridine
man q	beta,D-mannosylqueuosine
mcm5s2u	5-methoxycarbonylmethyl-2-thiouridine
mcm5u	5-methoxycarbonylmethyluridine
mo5u	5-methoxyuridine
ms2i6a	2-methylthio-N6-isopentenyladenosine
ms2t6a	N-((9-beta-D-ribofuranosyl-2-methyltiopurin-6-yl)carbamoyl)threonine
mt6a	N-((9-beta-D-ribofuranosylpurine-6-yl)N-methyl-carbamoyl)threonine
mv	uridine-5-oxyacetic acid methylester
o5u	uridine-5-oxyacetic acid (v)
osyw	wybutoxosine
p	pseudouridine
q	queuosine
s2c	2-thiocytidine
s2t	5-methyl-2-thiouridine
s2u	2-thiouridine
s4u	4-thiouridine
m5u	5-methyluridine
t6a	N-((9-beta-D-ribofuranosylpurine-6-yl)carbamoyl)threonine
tm	2'-O-methyl-5-methyluridine
um	2'-O-methyluridine

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Abbreviation	Modified base description
yw	wybutosine
x	3-(3-amino-3-carboxypropyl)uridine, (acp3)u
OTHER	Other (/note qualifier に修飾塩基を記載します)

[References]

- Sprinzl, M. and Gauss, D.H. Nucl Acid Res 10, r1 (1982).(note that in Cornish_Bowden, A. Nucl Acid Res 13, 3021-3030 (1985)the IUPAC-IUB declined to recommend a set of abbreviations for modified nucleotides)

- Feature Table Definition: 7.4.2 Modified base abbreviations

Amino Acid

Amino Acid Codes

The amino acid code that is used with the International Nucleotide Sequence Database is as follows.

These amino acids are described with one letter abbreviation in /translation qualifier of CDS feature.

The listed amino acid abbreviations are legal values for qualifiers /transl_except and /anticodon.

Those that are not included in "Amino acid codes", please refer to Modified and unusual Amino Acids.

Abbreviation	1 letter abbreviation	Amino acid name
Ala	A	Alanine
Arg	R	Arginine
Asn	N	Asparagine
Asp	D	Aspartic acid
Cys	C	Cysteine
Gln	Q	Glutamine
Glu	E	Glutamic acid
Gly	G	Glycine
His	H	Histidine
Ile	I	Isoleucine
Leu	L	Leucine

Abbreviation	1 letter abbreviation	Amino acid name
Lys	K	Lysine
Met	M	Methionine
Phe	F	Phenylalanine
Pro	P	Proline
Pyl	O	Pyrrolysine
Ser	S	Serine
Sec	U	Selenocysteine
Thr	T	Threonine
Trp	W	Tryptophan
Tyr	Y	Tyrosine
Val	V	Valine
Asx	B	Aspartic acid or Asparagine
Glx	Z	Glutamic acid or Glutamine
Xaa	X	Any amino acid
Xle	J	Leucine or Isoleucine
TERM		termination codon

[References]

- IUPAC-IUB Joint Commission on Biochemical Nomenclature.Nomenclature and Symbolism for Amino Acids and Peptides. Eur. J. Biochem. 138: 9-37 (1984).
- Feature Table Definition: 7.4.3 Amino acid abbreviations

Modified and Unusual Amino Acids

For other amino acids, those that are not included in Amino Acid Codes, abbreviation listed below is used. All of these amino acids are described with one letter abbreviation "X" in /translation qualifier of CDS feature.

Abbreviation	Amino acid name
Aad	2-Aminoadipic acid
bAad	3-Aminoadipic acid

Abbreviation	Amino acid name
bAla	beta-Alanine, beta-Aminoproprionic acid
Abu	2-Aminobutyric acid
4Abu	4-Aminobutyric acid, piperidinic acid
Acp	6-Aminocaproic acid
Ahe	2-Aminoheptanoic acid
Aib	2-Aminoisobutyric acid
bAib	3-Aminoisobutyric acid
Apm	2-Aminopimelic acid
Dbu	2,4-Diaminobutyric acid
Des	Desmosine
Dpm	2,2'-Diaminopimelic acid
Dpr	2,3-Diaminoproprionic acid
EtGly	N-Ethylglycine
EtAsn	N-Ethylasparagine
Hyl	Hydroxylysine
aHyl	allo-Hydroxylysine
3Hyp	3-Hydroxyproline
4Hyp	4-Hydroxyproline
Ide	Isodesmosine
aIle	allo-Isoleucine
MeGly	N-Methylglycine, sarcosine
MeIle	N-Methylisoleucine
MeLys	6-N-Methyllysine
MeVal	N-Methylvaline
Nva	Norvaline
Nle	Norleucine
Orn	Ornithine

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Abbreviation	Amino acid name
OTHER	Other ((Amino acid not found in this list should be described in /note qualifier)

[References]

- Feature Table Definition: 7.4.4 Modified and unusual Amino Acids

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The Mikro Pulverizer® Hammer & Screen Mill is a high speed mechanical impact mill designed for continuous size reduction of a wide range of materials down to D90 < 45 μm. This device has evolved into the preeminent industrial mill with thousands of worldwide installations.

Design & Options:

- Laboratory (1 HP) to production (200 HP) available
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- Easy to operate and maintain
- Available in mild steel, stainless steel and with wear protection
- Pressure shock resistant (PSR) models available
- Various configurations available to produce a wide range of products and results
- Very durable & reliable designs for years of production
- Compact and easy to clean design
- Suitable for Chemical, Pharmaceutical, Food, Mineral and Cosmetic applications
- Cryogenic grinding possible

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Description **Materials** **Resources**

The Mikro Pulverizer® consists of a high speed rotor assembly fitted with hammers. The grinding chamber is fitted with a cover containing a multiple deflector liner and a retaining screen at the point of mill discharge.

A screw mechanism is often used to introduce feed material into the grinding chamber. The grinding process is affected by three basic variables: the type of hammers, the rotor speed, and the size and shape of the screen opening.

There are two types of hammers: the “stirrup,” recommended where a fine particle size is desired; and the “bar,” which generates a coarser grind with a minimum of fines. Both types are tipped at the wearing edge with various abrasion resistant alloys. Rotor speed affects the fineness of the grind as follows: low speeds result in a coarse grind and high speeds produce a fine grind. Size and shape of the retaining screen openings also affect the product. In general, a finer screen opening will result in a finer grind. The retaining screen does not function as a sifting screen, except in coarse granulations.

Controlled Particle Size

Optimum particle size reduction can greatly affect chemical reaction speeds, solubility, weight, color, volume, appearance and strength of ground products. Mikro-Pulverizers® provide accuracy in particle size control because the grinding action is entirely mechanical. Once a mill is set to deliver a certain product, it will continue to produce exactly the same result without adjustment.

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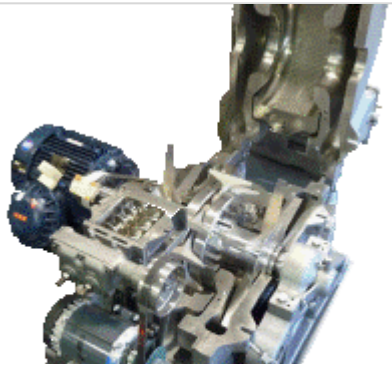
Mikro Pulverizers® grind, blend and disperse in a single operation. Intensive action thoroughly mixes dissimilar ingredients into a finished product. Heat sensitive materials are handled by adjustment of mill speed, hammers, screen and discharge air relief, as well as with pneumatic conveying. Conditioned air may be bled into a grinding chamber, or the feed may be pre-conditioned or chilled. The MikroPulverizers® comes in many model sizes from small pilot scale to massive production models.

Related Products



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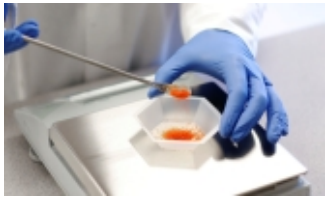

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What Gives Meat Its Color?

Beef

Pork

Fish

There are basically two types of meat: dark and white.

Red, or dark meat is made up of muscles with fibers that are called *slow-twitch.* These muscles are used for extended periods of activity, such as standing or walking, and need a consistent energy source. The protein *myoglobin* stores oxygen in muscle cells, which use oxygen to extract the energy needed for constant activity. Myoglobin is a richly pigmented protein. The more myoglobin there is in the cells, the redder, or darker, the meat.

When dark meat is cooked, myoglobin's color changes depending on what the meat's interior temperature is. Rare beef is cooked to 140° F, and myoglobin's red color remains unchanged. Above 140° F, myoglobin loses its ability to bind oxygen, and the iron atom at the center of its molecular structure loses an electron. This process forms a tan-colored compound called *hemichrome,* which gives medium-done meat its color. When the interior of the meat reaches 170° F, hemichrome levels rise, and the myoglobin becomes *metmyoglobin,* which gives well-done meat its brown-gray shade.

White meat is made up of muscles with fibers that are called *fast-twitch.* Fast-twitch muscles are used for quick bursts of activity, such as fleeing from danger. These muscles get energy from glycogen, which is also stored in the muscles.

White meat has a translucent "glassy" quality when it is raw. When it's cooked, the proteins denature and recombine, or *coagulate,* and the meat becomes opaque and whitish.

Cows and pigs are both sources of dark meat, though pig is often called "the other white meat." Pigs' muscles do contain myoglobin, but the concentration is not as heavy as it is in beef. Chickens have a mixture of both dark and white meat, and fish is mainly white meat.

Different types of meat require different cooking times. The best way to determine if meat is done is to use a meat thermometer to check the internal temperature. Beef can be cooked to a variety of temperatures: rare (140° F), medium (160° F), and well-done (170° F). Pork, chicken, and fish

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U.S. Patent No. 11,013,250

have less leeway. It's recommended that pork be cooked to 170° F, chicken to 180° F, and fish to 165° F.

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ScienceDirect

Food Chemistry
Volume 345, 30 May 2021, 128761

Reinvestigation of 2-acetylthiazole formation pathways in the Maillard reaction

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Received 17 August 2020, Revised 15 October 2020, Accepted 27 November 2020, Available online 2 December 2020, Version of Record 10 December 2020.

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https://doi.org/10.1016/j.foodchem.2020.128761

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Highlights

- The C-4 and C-5 of 2-acetylthiazole were also derived from the carbons of glucose.
- The potential of glyoxal in the formation of 2-acetylthiazole for the first time.
- The formation pathways of 2-acetylthiazole were elucidated.

Abstract

2-Acetylthiazole possesses a nutty, cereal-like and popcorn-like aroma and a low odor threshold, and this compound has been identified in some processed foods, while the formation pathway of 2-acetylthiazole has not been clearly elucidated. Here, a model reaction of D-glucose and L-cysteine was constructed to

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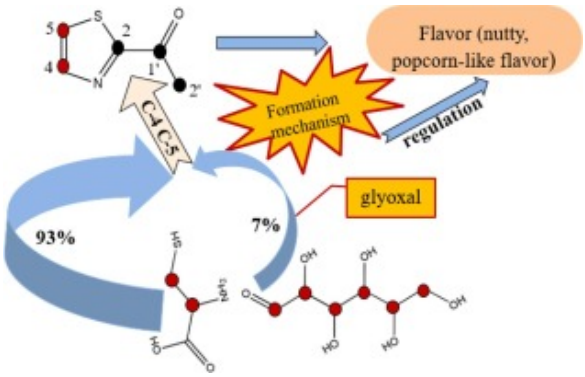
investigate the formation pathway of 2-acetylthiazole. L-Cysteine, D-glucose and the corresponding intermediates, namely, dicarbonyl compounds (DCs), were involved in the formation of 2-acetylthiazole and detected by high-performance liquid chromatography with tandem mass spectrometry (HPLC-MS/MS), high-performance ion chromatography (HPIC) and HPLC, respectively. The carbon module labeling (CAMOLA) technique revealed that the C-4 and C-5 of 2-acetylthiazole were derived from the carbons of glucose. The potential of glyoxal, which is degraded by glucose, to form 2-acetylthiazole was revealed for the first time. A novel route to form 2-acetylthiazole by the reaction of glyoxal and methylglyoxal produced by D-glucose with H_2S and NH_3 produced by L-cysteine was proposed.

Graphical abstract



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2-Acetylthiazole; L-cysteine; D-glucose; Glyoxal; Formation pathway

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362    1#$aPrint began with vol. 1 (July 1976).
538    ##$aMode of access: World Wide Web.
588    ##$aDescription based on: Vol. 52, issue 1 (1995); title from
contents screen (ScienceDirect, viewed Oct. 13, 2003).
588    ##$aLatest issue consulted: Vol. 83, issue 4 (Dec. 2003),
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906    ##$aJOURNAL
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Volatile Character-Impact Sulfur Compounds and their Sensory Properties

Apr 6th, 2016 | By Mans H. Boelens, Leo J. van Gemert

Volatile organic sulfur compounds are important constituents for the flavor of food, beverages and natural isolates. Character-impact sulfur compounds have been found in foods (bread, potato and prepared meat), beverages (beer and coffee), vegetables (aIlium species, truffle and radish), fruits (grapefruit, pineapple, grape, tomato, melon, passion fruit and black currant) and natural isolates like essential oils, absolutes and oleoresins (rose, hop, galbanum, absinth, cassia, patchouli, pepper, helichrysum and geranium). These character-impact sulfur compounds are, often in a certain low concentration, characteristic for the sensory properties of the material. Although these facts are generally accepted in the flavor and fragrance industry, still some questions can be put forward, namely:

l What are the identities of these compounds?

l What are their sensory properties? That is, what is their odor and flavor character and in which concentration can they be perceived?

In this article we will try to answer these questions as much as possible mainly based on a survey of the available literature.

Click to download the complete article.

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Customizing small flavor molecules by oligomeric glycosylation

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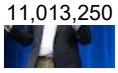

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More in Ingredients

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SWEET APPLICATIONS

Silky Smooth MicroCreamery Debuts All-Natural Sugar-Free Keto-friendly Sweetener Blend

The blend is said to be the world's only flavor-enhancing sweetener of its kind.

Nov 2nd, 2022

INGREDIENTS

Organoleptic Characteristics of Flavor Materials

This month's column features valeric acid, savory oil, orange terpenes and more.

Nov 1st, 2022

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MilliporeSigma

INGREDIENTS

Flavor Bites: Ethyl 3-hydroxybutyrate

The ingredient applies mostly to fruit flavors and often forms a significant component of the perception of freshness.

Oct 31st, 2022

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3 Ways to Transform Citrus Critics into Connoisseurs

Citrus is one of the most prevalent flavors in the world, yet a large percentage of consumers remain unconvinced. Discover three strategies to help transform these citrus critics into connoisseurs.

Nov 2nd, 2022

NEWS

See The Latest Buzzing Headlines in Flavor and Fragrance

See which companies made headlines this week in F&F.

Oct 21st, 2022

Motif Exhibit 1011, Page 1094 of 1241

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U.S. Patent No. 11,013,250

VIDEO

[video] Discover IFF NEO™ for Global Beverage Market Formulations

P&F+ connects with IFF's RE-MASTER CITRUS™ innovation flavorist, Natalie Mordt-Sullivan, to discuss the usage and versatility of IFF NEO™.

Oct 20th, 2022

INGREDIENTS

BioNootkatone, the Gold Standard for Natural Nootkatone

Woody, peely, and bursting with juicy nuance, BioNootkatone is an indispensable ingredient for natural citrus flavor creation. Developed through biotechnology, it is sustainable and independent of the citrus supply chain.

Oct 19th, 2022

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NEWS

IFF Debuts Neo Citrus Portfolio

The IFF Neo collection of natural citrus flavors is developed for beverage applications, as well as in liquid and dry formulations.

Oct 17th, 2022

AUDIO

[podcast] Two Sense: *Flavorcon* Speaker Cyndie Lipka Prepares to Take the Stage

Get a taste of Lipka's upcoming session with VCF Online and hear about what she's been up to lately!

Oct 17th, 2022

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FLAVOR

Perfumer & Flavoris+ October Issue Flavor Highlights

From industry insights to better-for-you treats, this month's issue features a variety of flavorful reads.

Oct 10th, 2022

FLAVORCON COVERAGE

Sneak Peek of *Flavorcon* 2022 Expo Hall

Find out what a selection of exhibitors plan on showcasing at the two-day event.

Oct 7th, 2022

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300	__	|**a** volumes : |**b** illustrations ; |**c** 28 cm
310	__	|**a** Twelve times a year, |**b** 2006-
321	__	|**a** Bimonthly, |**b** 1980-2003
321	__	|**a** Eight times a year, |**b** 2004-2005
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362	0_	|**a** Vol. 5, no. 1 (Feb./Mar. 1980)-
500	__	|**a** Published: Carol Stream, IL, <1998->
588	__	|**a** Latest issue consulted: Vol. 31, no. 4 (spring 2006).
590	__	|**a** SERBIB/SERLOC merged record
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Beyond Meat vs. Impossible Foods: The very real battle between the biggest ‘fake-meat’ competitors

Adam McQueen

As is my usual routine, I watched an embarrassing amount of basketball over the weekend. You know the days where you sit for so long that all you have to show for your past eight hours of existence is a full body imprint on the couch.

I’d say I’m ashamed to admit this, but anyone who knows me won’t be surprised at all.

More importantly, there are three big questions that have been bouncing around my brain following an ungodly amount of television consumption.

- How can anyone think playoff basketball isn’t the best?
- What species is LeBron, because he’s definitely not human?
- Does *every* single restaurant now boast a plant-based meat alternative?

Nearly every single food-related commercial I sat through advertised their newest plant-based alternative. Starbucks. Burger King. McDonald’s.

You name it, and they’re likely spending serious advertising money to showcase their newest plant-based recipes.

It got me thinking: how big has this market gotten, and who’s cashing in?

As it turns out, there’s some very *real* competition happening in the ‘fake-meat’ world.

(https://web.archive.org/web/20220331013638mp_/https://go.klue.com/cs/c/?cta_guid=605cbdb2-5a1e-421d-bb2d-f453ca3af543&signature=AAH58kFQ6eK69odyfyiGe2wAX2PxadsGVw&placement_guid=e198ad49-3605-4fe6-8ae6-a57796a07150&click=b3361766-82cd-45b5-a457-7881667e4095&hsutk=&canon=https%3A%2F%2Fklue.com%2Fblog%2Fbeyond-meat-vs-impossible-foods-the-very-real-battle-between-the-biggest-fake-meat-competitors&portal_id=2241989&redirect_url=APefjpFUR1CxsqB9CaEfwUx0TBhRc0bslGLphS5gsnpfsfprMQZIC4-MJcASi5lqNc2-TrsnVBIROQtwh9QF9ePcuHfZNQkKKfxV2G87iRX4FefNK7Vrq7kPDY9jYHe6XhMSP5w6bA-P)

Who sits atop the meatless food chain?

According to **Bloomberg, (https://web.archive.org/web/20220331013638/https://www.bloomberg.com/news/articles/2021-04-16/beyond-meat-bynd-impossible-foods-battle-over-future-of-fake-meat-industry)** the market for plant-based meat alternatives is expected to reach $450 billion by 2040. In the U.S. alone, plant-based meat sales **grew by 45%, (https://web.archive.org/web/20220331013638/https://www.fooddive.com/news/plant-based-food-worth-7b-in-2020-posting-27-growth/597865/)** for a total of $1.4 billion.

And leading the way for this plant-based revolution has been Beyond Meat. The company established themselves in 2009 and enjoyed a significant first mover advantage as the first to market with mainstream ‘meatless meat’ products.

Beyond’s products are found in 42,000 U.S. restaurants, 80+ international markets, and account for 22% of the frozen/refrigerated retail meat alternatives. After going public in 2019, the company quickly blew up to **a $13 billion valuation.**

(https://web.archive.org/web/20220331013638/https://www.forbes.com/sites/oliviergarret/2019/09/11/missed-out-on-beyond-meat-buy-these-2-ipos-this-week/?sh=5212d3a31b60) They were considered disruptors in the market, trying to make a dent in the gargantuan (and seemingly unsustainable) meat industry.

Meat alternatives were nothing new. But Beyond’s strategy was. Rather than confining themselves to the niche vegetarian audience, Beyond targeted the much larger market of meat-eaters.

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Vox **wrote in a 2019 article, (https://web.archive.org/web/20220331013638/https://www.vox.com/2019/5/28/18626859/meatless-meat-explained-vegan-impossible-burger)** that Beyond’s strategy was to “ensure that their product has the flavour, macronutrient balance, and cooking experience of meat.”

If they could nail these key parts of their food and cater more towards meat-eaters, not only did it create a much larger total addressable market of consumers, but their product would already be differentiated within that market.

As it turned out, the feel-good ethical and health reasons for consuming meat alternatives actually helped their product stand out far better than having to compete against other vegetarian food options.

They even commissioned the **University of Michigan to research and compare the environmental impact of producing a Beyond Burger and a regular beef patty. (https://web.archive.org/web/20220331013638/http://css.umich.edu/publication/beyond-meats-beyond-burger-life-cycle-assessment-detailed-comparison-between-plant-based)** Talk about some data-backed marketing!

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Beyond set out to lower the barrier to turn meat-eaters into consumers, and their distribution strategy followed suit. Their focus was to make plant-based alternatives mainstream.

“The promise there was, ‘we’re going to have plant-based protein’, we’re not going to sell it in the frozen veggie food aisle, we’re going to sell it in the meat aisle of the grocery store, we’re going to go to restaurants, we’re going to go to retail. We’ll expand our distribution and go overseas. There’s a constant flow of product innovation and a constant expansion of product distribution,” said Al Root, Sr. Writer at Barron’s on ‘**The Readback’ podcast. (https://web.archive.org/web/20220331013638/https://open.spotify.com/episode/3Z3LUxciFHyE5BH51kZiRz)**

Beyond’s partnership with dine-in restaurants was a strong brand play, and it also normalized their product to meat-eaters. While some consumers might be skeptical about cooking it themselves, there’s more comfort in trying it at a restaurant.

Although this strategy allowed Beyond to climb atop of the meatless food chain and make a dent in the larger meat industry, the early success of their approach has paved the way for serious competition to enter the fray.

Impossible Foods are coming for the crown

Just like my weekend viewing showcased the new generation of hoopers that are in line to take over the league from the elder statesmen, there are newer plant-based meat alternatives that are taking bites out of Beyond Meat's lead.

Their competitive advantage in terms of having a monopoly of power in the market has been dwindling, and Impossible Foods has emerged as their most serious competitor. There are two main reasons why Impossible has made inroads.

The pandemic dip

Beyond's strategy to place their product within dine-in restaurants took a significant hit due to the pandemic.

Their revenue split from big restaurants to small operators **went from 30%-70% in 2019, to 42%-58% in mid 2020. (https://web.archive.org/web/20220331013638/https://www.bloomberg.com/news/articles/2021-04-16/beyond-meat-bynd-impossible-foods-battle-over-future-of-fake-meat-industry)** And this revenue change wasn't because of adding large chains, but due to the rapid decline in smaller businesses.

Meanwhile, the majority of Impossible Food's initial partnerships were with large chain restaurants that offered drive-thru and delivery options. These distributors were more resilient during the pandemic, allowing Impossible to scale quickly and reduce costs.

Beyond is now pivoting towards larger chain partnerships, most notably with McDonalds and Yum Brands!, but they're in the unfamiliar territory of playing catch-up.

Pricing wars in the battle for market share

When a first mover like Beyond has a monopoly advantage, they can price its product without the competitive pressures from a rival.

It's a necessary evil for consumers **as the Rutgers Business Review explains (https://web.archive.org/web/20220331013638/https://rbr.business.rutgers.edu/article/sustaining-first-mover-advantage-fast-growing-meat-substitute-market)**:

"The first-mover spends a considerable amount of time and resources in creating and introducing its product in the market."

But, this high price point limits your consumer base. And while Beyond’s strategic decision to compete against meat products has paid off, they were still a long way away from matching cheap meat prices.

Meanwhile, Impossible Food’s rapid growth over the pandemic — hitting production records and achieving greater economies of scale — allowed them to drastically slash their prices by 20% in restaurants and grocery stores earlier this year in an attempt to better compete with meat. They made their product more buyable to the broader consumer base, and with an eye on taking advantage of Beyond’s leader status.

“We were thinking about cost reductions and getting to the cost structure of commodity ground beef from the very beginning,” said David Lee, chief financial officer of Impossible Foods, in **an interview with Vox. (https://web.archive.org/web/20220331013638/https://www.vox.com/future-perfect/2021/2/2/22260454/impossible-foods-burger-plant-based-meat)** “We knew that if we had the best product at the same cost, then consumers would vote with their stomachs.”

The more competition… the better?

While Impossible Foods has stolen market share from Beyond in the meat alternative space, ultimately the roadmap that Beyond has set out actually means that these competitors are working in lockstep.

Yes, they’re competing against each other as the preeminent meat alternative, but both are angling to take market share from agricultural companies producing animal meats.

Considering that plant-based meats are only **an estimated 3% of packaged meat sales in the U.S., (https://web.archive.org/web/20220331013638/https://www.bloomberg.com/news/articles/2021-04-16/beyond-meat-bynd-impossible-foods-battle-over-future-of-fake-meat-industry)** the rise in meat alternative competition can lift all boats. Beyond’s year-over-year sales growth continues to accelerate despite their market share shrinking.

And many other companies — even massive meat producers — are now **creating their own meatless product lines, (https://web.archive.org/web/20220331013638/https://www.forbes.com/sites/greatspeculations/2020/09/14/competition-will-eat-beyond-meat-alive/?sh=63fc73b02946)** allowing even more consumers to try plant-based options.

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The lessons of Beyond’s approach are applicable across any business. They thought about their competitive set beyond just the narrow scope of the vegetarian meat market — they went after all meats. Being able to see the forest from the trees is how unicorn businesses are born.

And now Beyond has paved the way for competitors to flood the market, which isn’t bad for them either! As the established leader that still possesses the best brand awareness amongst customers, more products in the category will only help. As Crispin Read mentioned in his article, **‘Positioning Done Right’: (https://web.archive.org/web/20220331013638/https://www.productmarketinghive.com/positioning-done-right-are-you-marketing-your-competitor/)**

“A challenger in a competitive market is guilty until proven innocent. The leader is the obvious choice. If you fail to differentiate, buyers will assume that there is no difference, and buy from the leader.”

However, Beyond must continue innovating its product, distribution, and partnerships in order to hold off competitors like Impossible from taking not only a slice of the pie, but the whole damn thing.

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(https://web.archive.org/web/20220331013638/https://klue.com/blog/netflix-competitive-advantage) 12 min

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Attachment 72a

Case No.: IPR2023-00208
U.S. Patent No. 11,013,250

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Hydrocolloids as thickening and gelling agents in food: a critical review

Dipjyoti Saha & Suvendu Bhattacharya

Journal of Food Science and Technology **47**, 587–597 (2010)

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Abstract

Hydrocolloids are widely used in many food formulations to improve quality attributes and shelf-life. The two main uses are as thickening and gelling agents. As thickening agents, they find uses in soups, gravies, salad dressings, sauces and toppings while as gelling agents, they are extensively used in products like jam, jelly, marmalade, restructured foods and low sugar/calorie gels. The role of specific hydrocolloids for thickening and for gel formation is reviewed pinpointing specific applications in food formulations and for product development.

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Case No.: IPR2023-00208
U.S. Patent No. 11,013,250

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362 1_ $aBegan with Apr. 1, 1953 issue.$zCf. OCLC.

500 $aDescription based on: Vol. 25, no. 1 (Jan.-Feb. 1977); title from cover.

500 $a"An American Chemical Society publication."

500 $aPlace of publication varies.

530 $aAlso available on the Internet.

530 $aAlso available on microfiche and microfim.

510 2_ $aBiological abstracts$x0006-3169

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362 1_ $aPrint began with vol. 1, no. 1 (Apr. 1953).

500 $aRefereed/Peer-reviewed

525 $aSome issues accompanied by supplementary materials or supporting information.

588 $aDescription based on print version record, (ACS Publications, viewed Aug. 29, 2006); title from contents page.

Case No.: IPR2023-00208
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588 $aLatest issue consulted: Volume 69, issue 43 (November 3, 2021), (ACS Publications, viewed Nov. 9, 2021).

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U.S. Patent No. 11,013,250

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Attachment 73b

OCLC 1800249 **No holdings in XXX - 596 other holdings**

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530 Also issued on microfiche, microfilm, and online.
550 Volumes for 1953-<54 published by the American Chemical Society; <Jan./Feb. 1976- by the Books and Journals Division, American Chemical Society.
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650 7 Plants $x Nutrition. $2 fast $0 (OCoLC)fst01066060
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655 7 Periodicals. $2 lcgft
710 2 American Chemical Society. $b Books and Journals Division.
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Attachment 74a

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Case No.: IPR2023-00208
U.S. Patent No. 11,013,250

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210 0_ $aJ. agric. food chem.

222 _0 $aJournal of agricultural and food chemistry

245 00 $aJournal of agricultural and food chemistry.

246 17 $aAgricultural and food chemistry

260 $aEaston, Pa. :$bAmerican Chemical Society, Books and Journals Division.

300 $avolumes :$billustrations ;$c31 cm

Case No.: IPR2023-00208
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362 1_ $aBegan with Apr. 1, 1953 issue.$zCf. OCLC.

500 $aDescription based on: Vol. 25, no. 1 (Jan.-Feb. 1977); title from cover.

500 $a"An American Chemical Society publication."

500 $aPlace of publication varies.

530 $aAlso available on the Internet.

530 $aAlso available on microfiche and microfim.

510 2_ $aBiological abstracts$x0006-3169

510 2_ $aBibliography of agriculture$x0006-1530

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510 2_ $aCoal abstracts$x0309-4979

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510 2_ $aVETDOC

550 $aVols. for 1953-<54> published by the American Chemical Society; <Jan./Feb. 1976-> by the Books and Journals Division, American Chemical Society.

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Case No.: IPR2023-00208
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650    _2    $aChemistry, Agricultural$vperiodicals.

710    2_    $aAmerican Chemical Society.

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260 $aWashington, DC :$bAmerican Chemical Society,$c1953-

300 $a1 online resource

310 $aWeekly,$b2012-

321 $aBiweekly,$b2002-2011

321 $aFrequency varies,$b1953-2001

336 $atext$btxt$2rdacontent

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362 1_ $aPrint began with vol. 1, no. 1 (Apr. 1953).

500 $aRefereed/Peer-reviewed

525 $aSome issues accompanied by supplementary materials or supporting information.

588 $aDescription based on print version record, (ACS Publications, viewed Aug. 29, 2006); title from contents page.

Case No.: IPR2023-00208
U.S. Patent No. 11,013,250

588 $aLatest issue consulted: Volume 69, issue 43 (November 3, 2021), (ACS Publications, viewed Nov. 9, 2021).

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Attachment 74b

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710 2 American Chemical Society. $b Books and Journals Division.
776 08 $i Online version: $t Journal of agricultural and food chemistry (Online) $x 1520-5118 $w (DLC)sn 98004593 $w (OCoLC)39281168
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856 41 $u http://pubs.acs.org/journals/jafcau/index.html

Attachment 75a

Case No.: IPR2023-00208
U.S. Patent No. 11,013,250

MARC Bibliographic Record

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Case No.: IPR2023-00208
U.S. Patent No. 11,013,250

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MMS IDs

Document ID:

999481975802121

Network Electronic IDs:

9911115105102121

Network Physical IDs:

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Attachment 75b

OCLC 5458841 **No holdings in XXX - 284 other holdings**

Continuing Resources

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338 volume $b nc $2 rdacarrier
362 0 Vol. 25, no. 1 (Jan. 1961)-v. 55, 12 (Dec. 1991).

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650 17 Landbouwkunde. $2 gtt
655 2 Periodical $0 (DNLM)D020492
655 3 Internet resource.
655 7 Periodicals. $2 fast $0 (OCoLC)fst01411641
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710 2 Nihon Nōgei Kagakkai.
776 08 $i Online version: $t Agricultural and biological chemistry (Online) $w (DLC) 65058099 $w (OCoLC)233145444
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856 41 $u http://bibpurl.oclc.org/web/15768 $u https://www.jstage.jst.go.jp/browse/bbb1961 $7 0
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Attachment 75c

Case No.: IPR2023-00208
U.S. Patent No. 11,013,250

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MARC Display | Labelled Display

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Library of Congress Authorities
URL: http://authorities.loc.gov/
Library of Congress Online Catalog
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Attachment 76a

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Attachment 76b

Case No.: IPR2023-00208
U.S. Patent No. 11,013,250

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LCCN Permalink: https://lccn.loc.gov/sh2007101986
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URL: https://catalog.loc.gov/

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Attachment 76c

Case No.: IPR2023-00208
U.S. Patent No. 11,013,250

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Washington, DC 20540

Library of Congress Authorities
URL: http://authorities.loc.gov/
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Attachment 76d

OCLC 1782923 **No holdings in XXX - 780 other holdings**

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090 $b
210 0 J. mol. biol.
222 0 Journal of molecular biology
245 00 Journal of molecular biology.
246 13 JMB $f <14 Jan. 2005-
260 London : $b Academic Press Ltd., $c [1959]-
260 3 $3 <Feb. 2002-; $a Amsterdam $b Elsevier
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310 Twenty-four no. a year, $b 2013-
321 6 times a year, $b 1959-1960
321 12 numbers a year, $b 1961-
321 Three times a month, $b <Jan. 6, 1976-

321 2 times a month, $b <20 Jan. 1985-Dec. 1993
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338 volume $b nc $2 rdacarrier
362 0 Volume 1, number 1 (April 1959)-
510 2 Chemical abstracts $x 0009-2258
588 0 Volume 1, number 1 (April 1959); title from cover
588 Latest issue consulted: V. 425, issue 20 (Oct. 23, 2013).
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650 17 Moleculaire biologie. $2 gtt
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Attachment 76e

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U.S. Patent No. 11,013,250

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680 __ |**i** Here are entered works on the science of studying bacteria. Works on bacteria are entered under |**a** Bacteria.
681 __ |**i** Note under |**a** Bacteria
906 __ |**t** 9351 |**u** te05 |**v** 0
953 __ |**a** xx00 |**b** td14

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Library of Congress Authorities
URL: http://authorities.loc.gov/
Library of Congress Online Catalog
URL: https://catalog.loc.gov/

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Attachment 76f

Case No.: IPR2023-00208
U.S. Patent No. 11,013,250

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670 __ |**a** MeSH browser, July 29, 2020 |**b** (Biochemistry. SN The study of the composition, chemical structures, and chemical reactions of living things. In MeSH Tree Structures under Biological Science Disciplines and under Chemistry)
670 __ |**a** Web. 3.
670 __ |**a** Hennepin.
670 __ |**a** McGraw-Hill dict. of sci. and tech. terms, c2003 |**b** (biochemistry [CHEM] The study of chemical substances occurring in living organisms and the reactions and methods for identifying these substances)
670 __ |**a** Tröjbom, M. Chemistry data from surface ecosystems in Forsmark and Laxemar-Simpevarp, 2010: |**b** p. 3 ("chemical composition of the regolith and biota of the terrestrial, limnic, and marine ecosystems")

670 __ |**a** Biology dictionary, via WWW, July 29, 2020 |**b** (Chemical Biology: a scientific discipline that combines chemistry and biology by using chemistry and chemical techniques to study biological systems. The main difference between chemical biology and biochemistry is that chemical biology involves adding novel chemical compounds to a biological system, while biochemistry is the study of chemical reactions that naturally happen inside organisms. Examples of chemical biology research include controlling cell division and other cell activities, using small molecules as targets for treatment, and manipulating stem cells. Differences between chemical biology and biochemistry: Chemical biology adds chemical compounds to biological systems in order to see what effect these chemicals have on cells and tissues. Chemical biologists often synthesize and add new compounds to cells. The goal of chemical biology research is to develop techniques that can eventually be applied to cells in a living organism, such as treatment options for cancer and other diseases. Biochemistry, on the other hand, is all about the chemical processes that already occur naturally in the cell. Instead of adding chemical compounds to cells to see the effects, biochemistry researchers study the chemical reactions that occur in organisms and the molecular makeup of these compounds. Biochemists also tend to study larger molecules like proteins and nucleic acids, while chemical biologists study smaller molecules) |**u** https://biologydictionary.net/chemical-biology/

680 __ |**i** Here are entered works on the study of naturally occurring chemical reactions in organisms. Works on the use of chemistry and chemical techniques to study biological systems are entered under |**a** Chemical biology.

681 __ |**i** Note under |**a** Chemical biology

910 __ |**a** Proposal saved by tc03 on 07/31/2020 at 10:12:44

952 __ |**a** Made for existing bibliographic records

952 __ |**a** LC pattern: Biophysics

906 __ |**t** 1125 |**v** 0

906 __ |**t** 2009 |**v** 0

Previous Next

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Attachment 76g

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LCCN Permalink: https://lccn.loc.gov/sh85014203
HEADING: Biology

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Washington, DC 20540

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Attachment 77a

MARC Bibliographic Record

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Case No.: IPR2023-00208
U.S. Patent No. 11,013,250

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530 $aAlso available on the Internet.

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510 2 Chemical abstracts $x 0009-2258
525 Supplements accompany some vols.
530 Also issued via the World Wide Web to subscribers of OCLC FirstSearch Electronic Collections Online and CRCnetBASE.
588 Latest issue consulted: Vol. 58, issue 17 (2018) (surrogate).
650 0 Food industry and trade $v Periodicals.
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Attachment 78b

OCLC 1568454 **No holdings in XXX - 493 other holdings**

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264 21 $3 1999-2001: $a Oxford, UK : $b Blackwell Science on behalf of the Federation of European Biochemical Societies
264 31 $3 2002-2004: $a Oxford, UK : $b Blackwell Pub.
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321 Monthly, $b Mar. 1967-
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338 volume $b nc $2 rdacarrier
362 0 Vol. 1, no. 1 (Mar. 1967)-v. 271, no. 23/24 (Dec. 2004).
500 Title from cover.
510 2 Chemical abstracts $x 0009-2258
515 Some issues combined.
530 Also issued on microfilm and microfiche by University Microfilms International, on CD-ROM, and online.
546 Articles in English, French, and German; summaries in English.
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650 6 Biochimie $v Périodiques.
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Attachment 79b

Case No.: IPR2023-00208
U.S. Patent No. 11,013,250

The Library of Congress

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MARC Display | Labelled Display

LC control no.: sh 85050185
LCCN Permalink: https://lccn.loc.gov/sh85050185
HEADING: Food Analysis

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URL: https://www.loc.gov/

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101 Independence Ave,
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Washington, DC 20540

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URL: https://catalog.loc.gov/

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Attachment 79c

OCLC 11841380 **No holdings in XXX - 275 other holdings**

Books

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250 2nd ed., rev. and expanded.
260 New York : $b M. Dekker, $c ©1985.
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Attachment 79d

Copyright United States Copyright Office

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Public Catalog

Copyright Catalog (1978 to present)
Search Request: Left Anchored Name = fennema owen r
Search Results: Displaying 3 of 4 entries

previous next

Labeled View

Food chemistry / edited by Owen R. Fennema.

Type of Work: Text
Registration Number / Date: TX0001651193 / 1985-09-04
Title: Food chemistry / edited by Owen R. Fennema.
Edition: 2nd ed., rev. and expanded.
Imprint: New York : M. Dekker, c1985.
Description: 991 p.
Series: Food science and technology ; 15
Copyright Claimant: Marcel Dekker, Inc.
Date of Creation: 1984
Date of Publication: 1985-05-15
Previous Registration: Prev. reg. as Principles of food science: food chemistry, 1976.
Basis of Claim: New Matter: revisions & additions.
Other Title: Food science and technology ; 15
Principles of food science: food chemistry
Names: Fennema, Owen R., 1929-
Marcel Dekker, Inc.

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Attachment 80a

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Case No.: IPR2023-00208
U.S. Patent No. 11,013,250

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Attachment 80b

OCLC 5458841 **No holdings in XXX - 284 other holdings**

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Attachment 81b

OCLC 3424642 **No holdings in XXX - 407 other holdings**

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500 "An international journal focusing on gene cloning and gene structure and function."
510 2 Chemical abstracts $x 0009-2258
530 Also issued via World Wide Web by subscription through ScienceDirect (Online service).
580 Vols. for 1996- includes separately paged section called: Gene-combis which is printed version of articles published electronically in Gene-combis on the World-Wide Web.
580 Online version has open access mirror journal: Gene X (Online), published 2019-2020.
588 1 Vol. 295, no. 1 (July 24, 2002).
650 0 Genetic engineering $v Periodicals.
650 0 Molecular cloning $v Periodicals.
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Attachment 82a

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530    ##$aAlso issued online.
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Attachment 82b

Case No.: IPR2023-00208
U.S. Patent No. 11,013,250

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500 Editor: 1924-<Aug. 1926 G.C. Robinson.
530 Also issued online.
555 Vols. 1 (1924)-17 (1938). 1 v.
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