

TREN RISET KOPI SEBAGAI PANGAN FUNGSIONAL DAN FARMASEUTIKAL



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 Sensory and Processing of Coffee and Cocoa.



Scan me!

Dipresentasikan pada Webinar dan Kuliah Umum Pusat Unggulan IPTEKS E2-KOLIM dan Program Studi Kimia Universitas Jambi

Sudah ngopi?



“

The powers of a man's mind are directly proportioned to the **quantity of coffee** he drinks.

MotivationalLines.com

— Sir James Mackintosh



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Sensation Wave of Coffee Pengembangan Produk Kopi

- 1st** wave - traditional coffee culture - commodity driven, mass consumption and dominance of bulk brew filter coffee
- 2nd** wave - branded chains - coffee shop culture, customised espresso-based beverages and globalisation, delicated taste
- 3rd** wave - artisan coffee - focus on quality, micro-roasting, handcrafting and sourcing transparency (origin)
- 4rd** wave - the science of coffee - accurate measurement in brewing, deep understanding of properties of coffee, water chemistry , development of brewing equipment, obsession to detail and perfect taste experience



GEOGRAPHICAL INDICATION : INDONESIAN COFFEE



Indonesia Coffee and Cocoa Research Institute | ICCRI

Source : Anonim, 2019
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35 INDONESIAN SPECIALTY COFFEE

Functional Food

“foods and food components that provide a health benefit beyond basic nutrition (for the intended population). These substances provide **essential nutrients** often **beyond quantities necessary** for normal maintenance, growth, and development, and/or other biologically active components that **impart health benefits** or **desirable physiological effects.**”

Functional food category	Selected functional food examples
Conventional foods (whole foods)	Garlic Nuts Tomatoes
Modified foods Fortified Enriched Enhanced	Calcium-fortified orange juice Iodized salt Folate-enriched breads Energy bars, snacks, yogurts, teas, bottled water, and other functional foods formulated with bioactive components such as lutein, fish oils, ginkgo biloba, St John’s wort, saw palmetto, and/or assorted amino acids
Medical foods	Phenylketonuria (PKU) formulas free of phenylalanine
Foods for special dietary use	Infant foods Hypoallergenic foods such as gluten-free foods, lactose-free foods Weight-loss foods

Monosaccharide of cell wall material fraction

- Rhamnose
- Fructose
- Arabinose
- Xylose
- Mannose
- Galactose
- Glucose

Amino Acids (g/kg DB)

Essential amino acids

- Arginine
- Leucine
- Phenylalanine
- Threonine
- Methionine
- Lysine
- Histidine
- Isoleucine

Non-essential amino acids

- Aspartic acid
- Valine
- Alanine
- Glycine
- Proline
- Glutamic acid
- Tyrosine
- Serine
- ΣEAA
- ΣNEAA
- ΣEAA/ ΣNEAA



Alkaloid (g/100 g dW)

- Caffeine
- Trigonelline

Bioactive (mg/g)

- 3-*O*-caffeoylquinic acid (mg/g)
- 4-*O*-caffeoylquinic acid (mg/g)
- 5-*O*-caffeoylquinic acid (mg/g)
- 3,4-di-*O*-caffeoylquinic acid (mg/g)
- 3,5-di-*O*-caffeoylquinic acid (mg/g)
- 4,5-di-*O*-caffeoylquinic acid (mg/g)
- 3-*O*-feruloylquinic acid (mg/g)
- 4-*O*-feruloylquinic acid (mg/g)
- 5-*O*-feruloylquinic acid (mg/g)
- Bioactive (relative quantity × 10000)
- 3,4-di-*O*-feruloylquinic acid (relative quantity × 10000)
- 3,5-di-*O*-feruloylquinic acid (relative quantity × 10000)
- 4,5-di-*O*-feruloylquinic acid (relative quantity × 10000)
- 3-*O*-p-coumaroylquinic acid (mg/100 g DB)
- 4-*O*-p-coumaroylquinic acid (mg/100 g DB)
- 5-*O*-p-coumaroylquinic acid (mg/100 g DB)
- p-coumaroylquinic acid (g/kg DW)
- As total CGA (g/100 g db)

Diterpenes (g/100 g)

- Cafestol
- Kahweol

Immune modulatory

Anti-inflammatory

antioxidant

anticancer

In-vitro

Coffee brew

Coffee extract

detoxification

Anti-diabetic

Anti-hyperlipidaemic

Anti-bacterial

caffeine

CGA

trigonelline

melanoidin

cafestol

kahweol

polyphenol

volatiles

Immune-modulatory

Anti-inflammatory

Antioxidant

Antifibrotic

Anticancer

In-vivo

Coffee brew

Coffee extract

Decaf coffee

Anti-anxiety

Radio-protective activity

Cardiovascular health

antihypertension

Blood-lipid modulation

Anti-diabetic

Body-weight regulation

Seizure modulation

“coffee” → 11,558

Food Chemistry: 343
 Science of Total environment: 181
 Journal of Cleaner Production: 142
 Chemospere: 138
 Heliyon: 128
 Food Research International: 125
 LWT: 106

“coffee AND bioactive” → 1,720

Food Chemistry: 128
 Food Research International: 64
 LWT: 48
 Food Bioscience (46)
 Trend in Food Science & Technology: 36



ELSEVIER

2022 - 2024

“coffee AND health” → 6,802

Food Chemistry: 223
 Science of Total environment: 126
 Chemospere: 100
 Food Research International: 95
 J. Of Cleaner Production: 83
 Heliyon: 76
 LWT: 64
 Food Control:

“coffee AND Indonesia” → 624

Heliyon: 19
 Food Chemistry: 16
 Journal of Cleaner production: 15
 Science of Total Environment: 15
 Food Control: 9
 Land use Policy: 9
 World Development: 9
 Food Research International: 7

“coffee” → 11,558

Agricultural and Biological Sciences: 3,056

Environmental Sciences: 1,949

Medicine and Dentistry: 1,799

Biochemistry, genetics, molecular biology: 1,386

“coffee AND bioactive” → 1,720

Agricultural and Biological Sciences: 4,650

Biochemistry, genetics and molecular biology: 2,710

Chemistry: 2,090

Medicine and Dentistry: 1,334

Pharmacology, toxicology and pharmaceutical science: 1,020



ELSEVIER

2022 - 2024

“coffee AND health” → 6,802

Agricultural and Biological Sciences: 2,005

Medicine and Dentistry: 1,448

Environmental Sciences: 1,233

“coffee AND Indonesia” → 624

Agricultural and Biological Sciences: 225

Environmental Science: 159

Social Sciences: 97

Energy: 82

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Medicine and Dentistry: 28



Tren riset produk kopi sebagai pangan fungsional

- Mutu sensory merupakan nilai jual terpenting pada produk kopi → ideal delivery system
- Presentasi produk kopi dalam bentuk lain kurang disukai atau kurang familiar dan dianggap mengurangi mutu sensory dari kopi itu sendiri

Riset yang muncul:

- Efek kesehatan berdasarkan konsumsi kopi secara umum
- Riset efek dari brewing technique terhadap aktivitas biologis
- *Enhanced coffee products*



Tren riset kopi uuntuk farmaseutikal

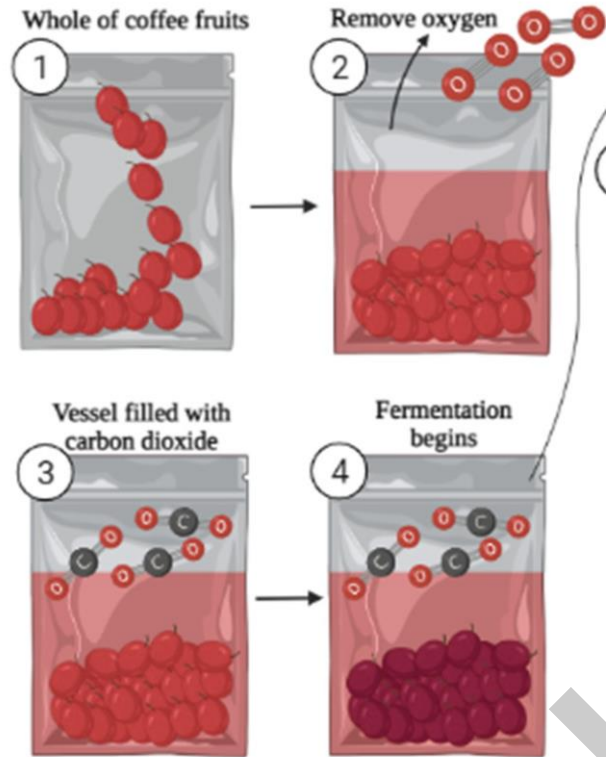
- Kurang populer karena mengeliminasi karakter sensori kopi
- Caffeine dan CGAs merupakan komponen yang banyak dieksplor

Riset yang muncul:

- Efek biologis In-vitro dan in-vivo ekstrak green bean
- Efek pengolahan terhadap karakteristik ekstrak green bean
- *Modified processing method*

*Peluang riset terkait pangan
fungsional dan farmaseutikal*

Coffee with balanced sensory and biological activities



New process



Fortified-coffee



New brewing/extraction method

Full Wash - Dry Hulling (West Indische Bereiding = WIB)	Full Wash - Wet Hulling (Sumateran Process)	Semi Wash / Pulp Natural Process	Natural Process	Dry Process – Cracked Chery
Coffee Cherry	Coffee Cherry	Coffee Cherry	Coffee Cherry	Coffee Cherry
Manual Sorting	Manual Sorting	Manual Sorting	Manual Sorting	Manual Sorting
Sorting By Water	Sorting By Water	Sorting By Water	Sun Drying (Moisture content \approx 14 %)	Coffee Cherry Cracking With Kneuzer Machine
Pulping Process	Pulping Process	Pulping Process	Hulling Process	Sun Drying (MC \approx 12 %)
Fermentation And Washing	Fermentation And Washing	Parchment Sun Drying (Moisture content < 12 %)	Green Coffee	Hulling Process
Parchment Sun Drying (Moisture content \approx 12 %)	Parchment Sun Drying (Moisture content > 30 %)	Hulling Process		Green Coffee
Hulling Process	Hulling Process	Green Coffee		
Green Coffee	Labu Coffee Bean Sun Drying (MC < 12 %)			
	Green Coffee			

Experimental process

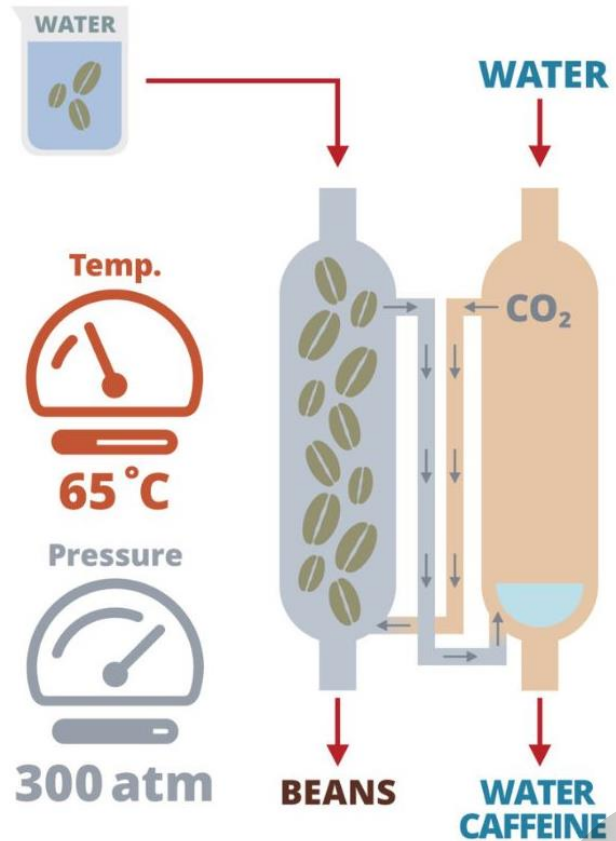
- Digested coffee
- Anaerobic fermentation
- Carbonic maceration
- Wine process
- Burundian process

Further reading on coffee processing:

[https://authors.elsevier.com/sd/article/S0308-8146\(23\)00105-X](https://authors.elsevier.com/sd/article/S0308-8146(23)00105-X)



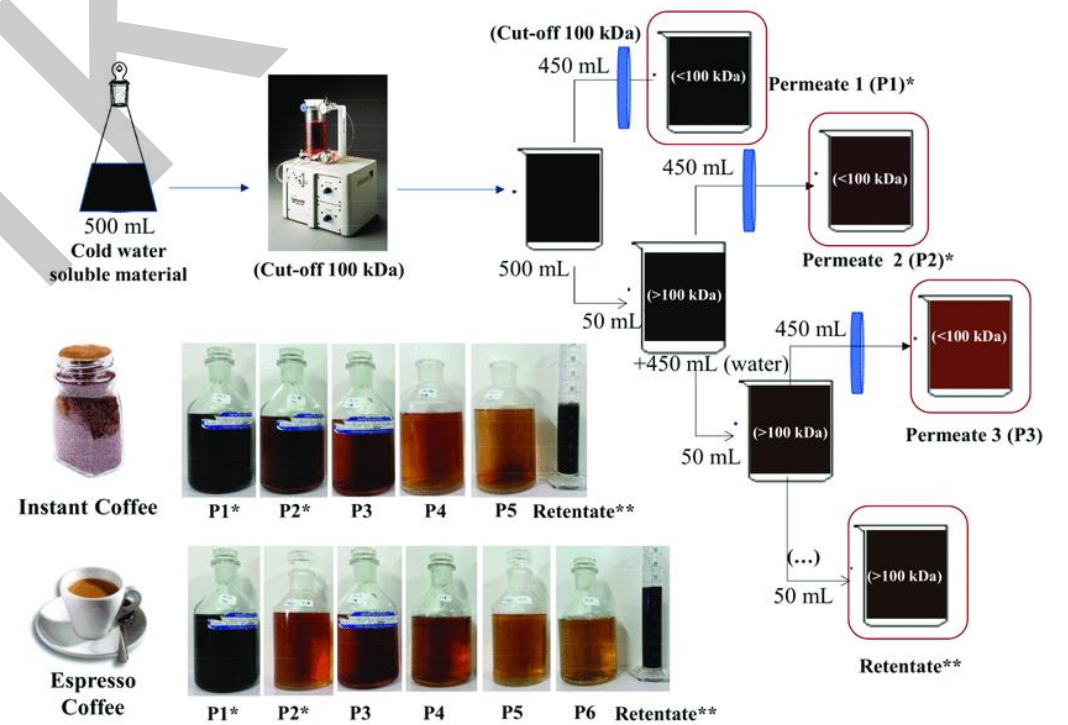
Quality coffee without undesired side-effect



Solvent-treated coffee



New variety of coffee



Selective fractionation

By-product utilization



Spent coffee ground



Coffee pulp

By-product utilization for specific dietary purposes



Materials Chemistry and Physics
Volume 240, 15 January 2020, 122171



New powder material obtained from spent coffee ground and whey protein; Thermal and morphological analysis

J. Osorio-Arias ^a, S. Delgado-Arias ^a, Y. Duarte-Correa ^a, E. Largo-Ávila ^b, D. Montaño ^c, Ricardo Simpson ^d, O. Vega-Castro ^a, ^c, ^e  



Food Chemistry
Volume 216, 1 February 2017, Pages 114-122



Use of spent coffee grounds as food ingredient in bakery products

Nuria Martínez-Saez ^a, Alba Tamargo García ^a, Inés Domínguez Pérez ^a, Miguel Rebollo-Hernanz ^a, Marta Mesías ^b, Francisco J. Morales ^b, María A. Martín-Cabrejas ^a, María Dolores del Castillo ^a  

[Show more](#) 



Future Foods
Volume 4, December 2021, 100090



A biorefinery approach towards valorization of spent coffee ground: Extraction of the oil by supercritical carbon dioxide and utilizing the defatted spent in formulating functional cookies

Abhinav Sharma , Aratrika Ray , Rekha S. Singhal  



LWT
Volume 119, February 2020, 108877



Reuse of spent espresso coffee as sustainable source of fibre and antioxidants. A map on functional, microstructure and sensory effects of novel enriched muffins

Carla Severini, Rossella Caporizzi, Anna Giuseppina Fiore, Ilde Ricci, Oral Mehmet Onur, Antonio Derossi  

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LWT
Volume 118, January 2020, 108784



Non-digestible oligosaccharides of green coffee spent and their prebiotic efficiency



Nivas M. Desai, Glory S. Martha, Nanishankar V. Harohally, Pushpa S. Murthy  



LWT
Volume 129, July 2020, 109523



Rheological, texture, structural, and functional properties of Greek-style yogurt fortified with cheese whey-spent coffee ground powder

Juan Osorio-Arias ^a, ^b, Angela Pérez-Martínez ^a, Oscar Vega-Castro ^a, Sergio I. Martínez-Monteaugudo ^c  

By-product utilization as the source of bioactive



Food Chemistry
Volume 348, 30 June 2021, 129061



Potential of green and roasted coffee beans and spent coffee grounds to provide bioactive peptides

Everton Ribeiro, Thais de Souza Rocha , Sandra Helena Prudencio



Ultrasonics Sonochemistry
Volume 89, September 2022, 106127



Optimization of ultrasound-assisted extraction of bioactive compounds from coffee pulp using propylene glycol as a solvent and their antioxidant activities

Hla Myo , Nuntawat Khat-udomkiri



International Journal of Biological Macromolecules
Volume 149, 15 April 2020, Pages 572-580



Procuring biologically active galactomannans from spent coffee ground (SCG) by autohydrolysis and enzymatic hydrolysis

Jie Gu ^{b, 1}, Wenhui Pei ^{a, 1}, Shuo Tang ^a, Fei Yan ^a, Zhenwen Peng ^a, Caoxing Huang ^a , Jinlai Yang ^c , Qiang Yong ^a



International Journal of Biological Macromolecules
Volume 230, 1 March 2023, 123245



Antioxidant and ultraviolet shielding performance of lignin-polysaccharide complex isolated from spent coffee ground

Lingying Fu ^{a, b}, Yue Gong ^{a, b}, Qi Zhou ^{a, b}, Zhiqiang Ou ^{a, b}, Xin Rao ^{a, b}, Songbin Wang ^{a, b}, Chunqing Huo ^c, Xueyu Du ^{a, b}



Journal of Pharmaceutical and Biomedical Analysis
Volume 189, 10 September 2020, 113421



Choline-chloride and betaine-based deep eutectic solvents for green extraction of nutraceutical compounds from spent coffee ground

Chiara Fanali ^a , Susanna Della Posta ^a, Laura Dugo ^a, Alessandra Gentili ^c, Luigi Mondello ^{a, b, d}, Laura De Gara ^a



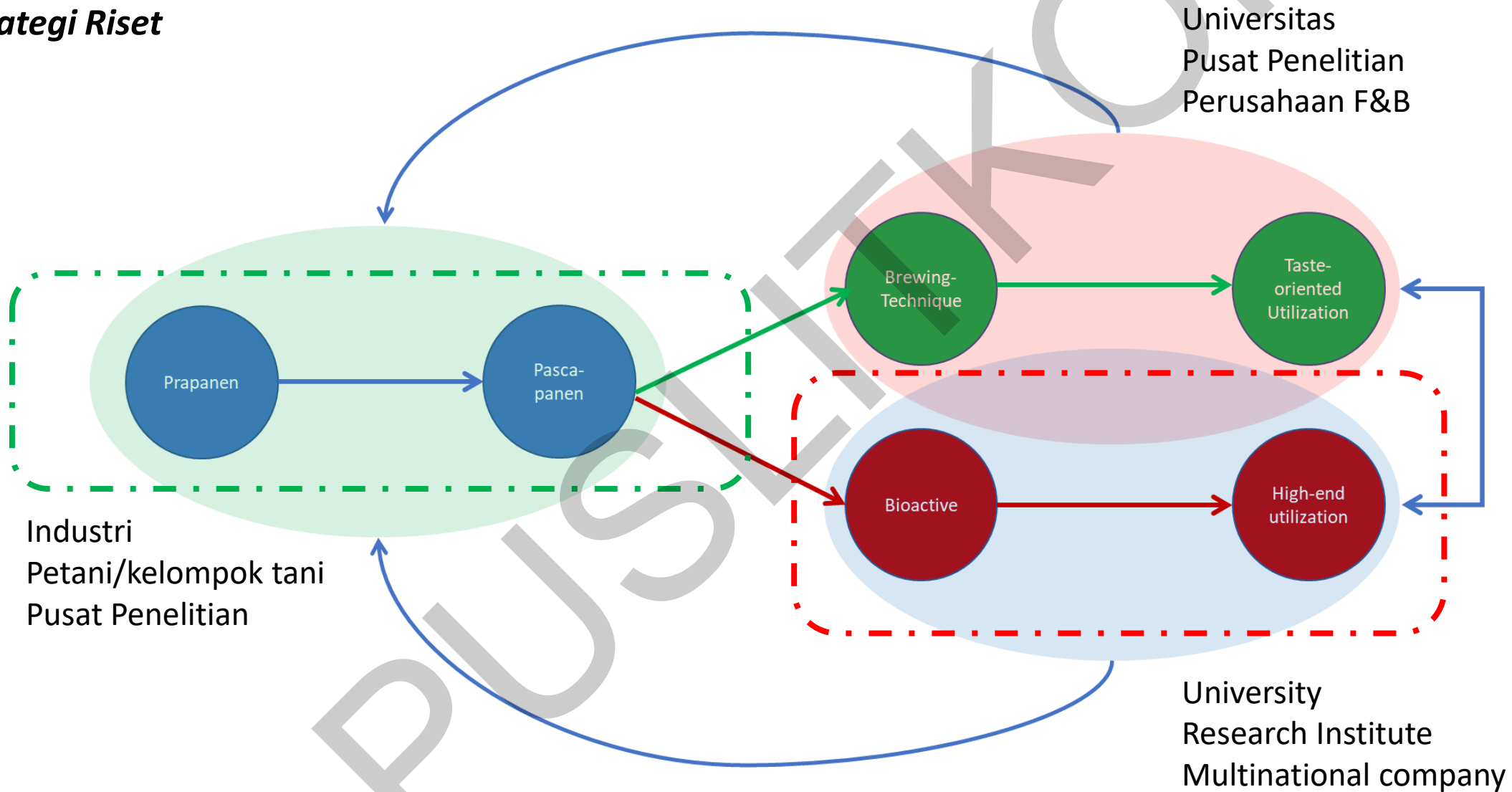
Sustainable Chemistry and Pharmacy
Volume 29, October 2022, 100777



Spent ground coffee oil using non-thermal plasma technology as a pre-extraction method: an *in vitro* analysis of collagen synthesis, cell proliferation and migration and toxicity

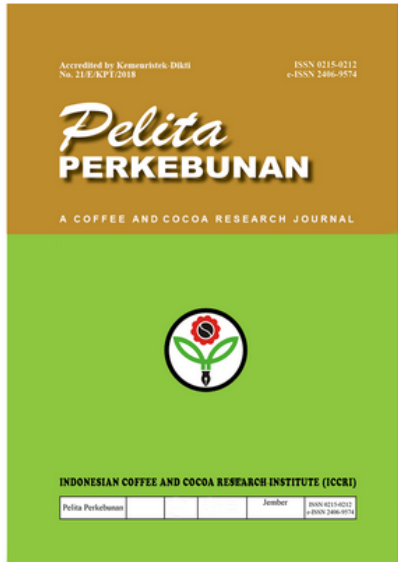
Anelise Leal Vieira Cubas ^a , Kênia Alexandra da Costa Hermann ^a, Elisa Flores Lins ^a, Marcelo Maraschin ^{b, c}, Daniela Sousa Coelho ^{b, c}, Elisa Helena Siegel Moecke ^a

Strategi Riset



Pusat Inovasi Sejak 1911





Pelita Perkebunan, A Coffee and Cocoa Research Journal (CCRJ):ISSN: 0215-0212; E-ISSN:2406-9574 doi:[10.22302/iccri.jur.pelitaperkebunan](https://doi.org/10.22302/iccri.jur.pelitaperkebunan), is an open-access international journal providing rapid publication of peer-reviewed articles related to coffee and cocoa commodities based on the aspects of agronomy, plant breeding, soil science, crop protection, postharvest technology, and social economy. Pelita Perkebunan also publishes the research findings for other commodities relevant to coffee and cocoa, i.e., agroforestry, shade trees, intercrops, and windbreakers. Papers dealing with results of original research on the above aspects are welcomed with **no page charge**.

Pelita Perkebunan is managed by **the Indonesian Coffee and Cocoa Research Institute (ICCRI)** and has been actively publishing the research findings since April 1985.

Further reading on coffee processing:

[https://authors.elsevier.com/sd/article/S0308-8146\(23\)00105-X](https://authors.elsevier.com/sd/article/S0308-8146(23)00105-X)



Pusat Inovasi Sejak 1911

