

BROMELAIN

BASICS

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WHAT IS BROMELAIN?

BROMELAIN IS A COMBINATION OF ENZYMES, CALLED **PROTEOLYTIC ENZYMES**, THAT HELP YOUR BODY ABSORB AND ASSIMILATE PROTEINS FROM FOODS

Bromelain is a concoction of sulfhydryl proteolytic enzymes. Depending upon the site of extraction it can be regarded as either **stem bromelain** (SBM) (EC 3.4.22.32) or **fruit bromelain** (FBM) (EC 3.4.22.33).

Bromelain remain enzymatic active over a broad spectrum and endure a range of pH (5.5 to 8.0) and temperature (35.5 to 71 °C).



PROTEOLYTIC ENZYME SUPPLEMENTS

BROMELAIN, PAPAINE, PANCREATIN, TRYPSIN AND CHYMOTRYPSIN ARE PROTEOLYTIC ENZYMES THAT ARE COMMONLY ADDED TO PROTEOLYTIC SUPPLEMENT BLENDS.

SOURCES OF BROMELAIN CONTENT

BROMELAIN IS ONLY AVAILABLE IN NATURAL FORM FROM THE **PINEAPPLE**
BOTH THE **STEM** AND THE **JUICE** FROM THE PINEAPPLE'S FLESH CONTAIN BROMELAIN.

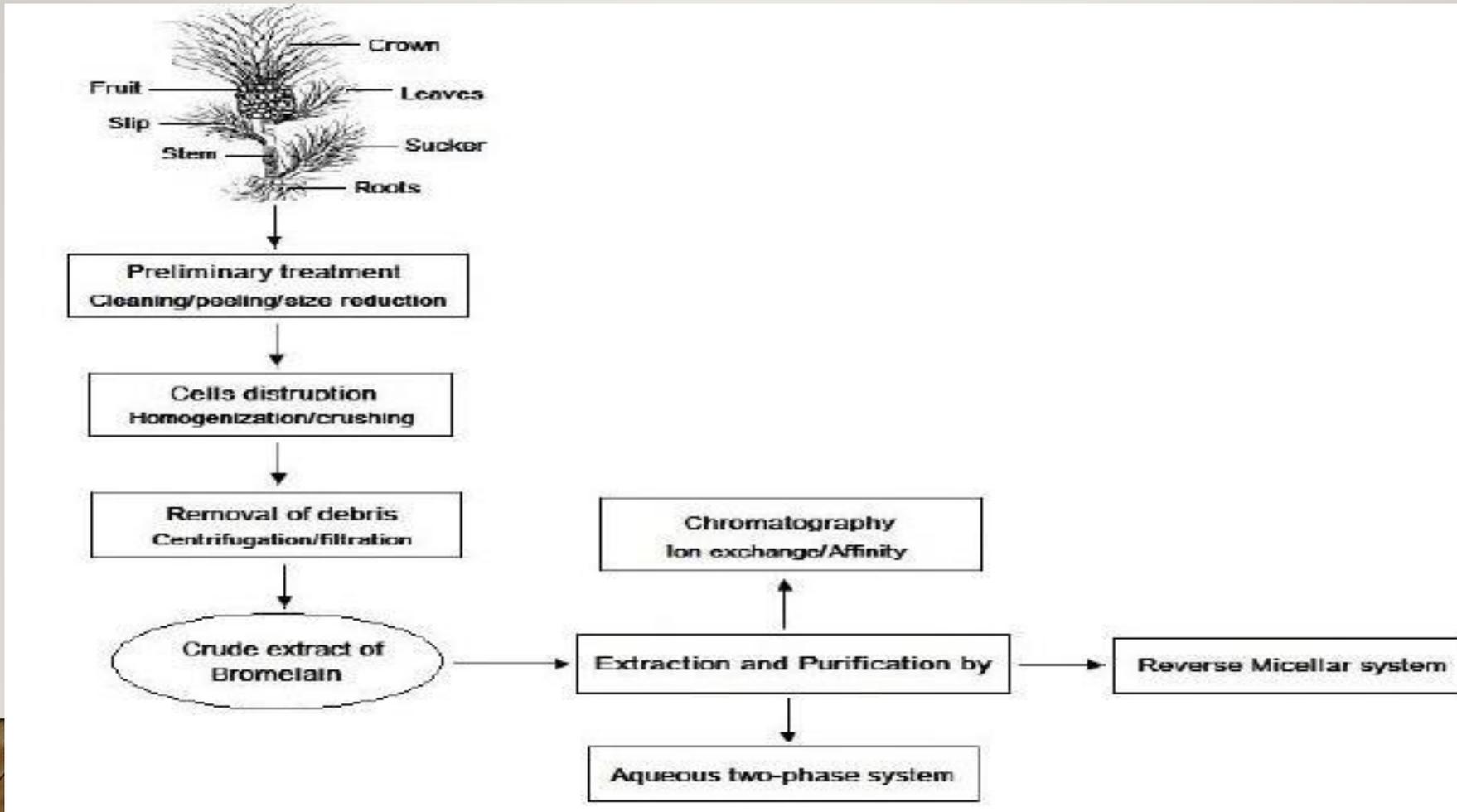


TECHNOLOGY

HIGHEST PURIFIED BROMELAIN IN LESS STEPS AND LOWEST COST.

Use of modernistic approach such as membrane filtration, Reverse micellar systems, Aqueous two phase extraction and chromatographic techniques have shown promise in this regard

EXTRACTION



HOW MANY MG OF BROMELAIN IN PINEAPPLE?

- Bromelain is determined in MCUs (milk clotting units) or GDUs (gelatin liquifying systems), where one GDU equates to roughly 1.5 MCU
- Bromelain exists in all parts of the pineapple plant, however the stem is the most common commercial source
- Enzyme activity as given in katal generally refers to that of the assumed natural target substrate of the enzyme. Enzyme activity can also be given as that of certain standardized substrates, such as [gelatin](#), then measured in *gelatin digesting units* (GDU), or milk proteins, then measured in *milk clotting units* (MCU). **The units GDU and MCU are based on how fast one gram of the enzyme will digest gelatin or milk proteins, respectively. 1 GDU equals approximately 1.5 MCU.^[2]**

BROMELAIN CONTENT

The stem of pineapple was extracted using a grater and then concentrated by a freeze dryer to obtain a pure concentrate. SDS-PAGE, Bradford assay and protease specific activity was used to analyze bromelain activity. The results of this study showed that bromelain from pineapple stem has a molecular weight between 19-22 kDa. Bradford assay showed 0.476 $\mu\text{g}/\text{mL}$ bromelain concentration. Bromelain activity of Non freeze dried (NF) extract showed 0.317 U/mL, while freeze dried (F) extract showed 0.212 U/mL. This study concluded that the pineapple stem has bromelain activity.

BROMELAIN ACTIVITY

Samples	Bromelain activity (CDU/mg)
Pineapple crown extract	426.49 ^d ± 8.76
Purified bromelain	501.08 ^b ± 3.31
Desalted bromelain	485.78 ^c ± 8.76
Bromelain powder	529.77 ^a ± 5.74

BROMELAIN CONTENT PINEAPPLE PARTS

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Table 1. The relative contents of bromelain in different parts of pineapple c.v. queen

Plant parts	Volume of crude extract (ml)	Activity (Units/ml)	Total activity (units)	Protein (mg/ml)	Total protein (mg)	Specific activity (units/mg)	Activity/wet weight of part (units/g)
Fruit pulp	93.0	8.24	766.3	0.68	63.20	12.13	15.33
Fruit skin	83.0	2.63	218.3	0.48	39.84	5.48	4.37
Stem	82.0	6.90	565.8	1.47	120.50	4.70	11.32
Crown	84.0	2.08	174.7	0.73	61.30	2.85	3.49
leaf							
True leaf	86.0	0.30	25.8	0.44	37.80	0.68	0.52

Table 4 Proteolytic activity of isolated bromelain from stem and fruits of *Ananas comosus*

Sample	Actual amount of NaOH rundown (ml)	Normality of NaOH (N)	Conc. of enzymes (mg/ml)	Enzyme activity (GDU/gram) (n=3)
Crude stem bromelain	1.05	0.1	0.70	2,100 ± 340
Crude fruit bromelain	1.15	0.1	1.11	1,450 ± 450
Stem bromelain (2000 rpm)	1.00	0.1	0.40	3,500 ± 480
Stem bromelain (4000 rpm)	1.01	0.1	0.51	2,772 ± 350
Stem bromelain (6000 rpm)	1.02	0.1	0.63	2,266 ± 330
Fruit bromelain (2000 rpm)	0.97	0.1	0.87	1,560 ± 500
Fruit bromelain (4000 rpm)	0.82	0.1	0.72	1,594 ± 500
Fruit bromelain (6000 rpm)	0.73	0.1	0.52	1,965 ± 400
Stem bromelain (2 nd eluate)	0.85	0.1	0.08	14,875 ± 500
Stem bromelain (4 th eluate)	0.95	0.1	0.14	9,500 ± 600
Fruit bromelain (2 nd eluate)	0.55	0.1	0.39	1,974 ± 280
Fruit bromelain (4 th eluate)	0.60	0.1	0.14	6,000 ± 290

THE GOOD

THIS ENZYME COMPOUND MAY HELP REDUCE THE INFLAMMATION OF MUSCLE AND SOFT TISSUES. THE ANTI-INFLAMMATORY PROPERTIES OF BROMELAIN MAY ALSO HELP RELIEVE PAIN AND STIFFNESS ASSOCIATED WITH CARPAL TUNNEL SYNDROME AND ARTHRITIS. BROMELAIN MAY ALSO HELP EASE DIGESTIVE DISTRESS AND FIGHT INFECTIONS.

THE BAD

BROMELAIN MAY CAUSE MILD SIDE EFFECTS SUCH AS DIARRHEA, INCREASED MENSTRUAL BLEEDING, VOMITING AND NAUSEA

THE UGLY

BROMELAIN MAY ALSO INTERACT WITH SEVERAL MEDICATIONS AND CHEMICALS. YOU SHOULD NOT CONSUME BROMELAIN IF YOU TAKE ANTICOAGULANTS, SUCH AS WARFARIN, ASPIRIN OR CLOPIDOGREL. BROMELAIN ALSO AMPLIFIES THE EFFECTS OF SEDATIVES, SUCH AS ALCOHOL, TRICYCLIC ANTIDEPRESSANTS, BARBITURATES, SLEEP AIDS AND BENZODIAZEPINES.

Companies in the field

- *Enzybel International SA
- * Biozym Gesellschaft für Enzymtechnologie mbH
- * Ursapharm Arzneimittel GmbH
- * Hong Mao Biochemicals Co. Ltd
- * Great Food Group of Companies

American Laboratories

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American Laboratories is an ingredient manufacturer founded in 1967 in Omaha, NE. The foundation of American Laboratories was built on the knowledge of providing Enzymes, Proteins, and Flavors to the Nutritional, Food, and Diagnostic industries with a motto of "Quality Ingredients you can Trust". Recently celebrated 50th year in business .and Expanded operations to include three separate facilities that total over 150,000 square feet of production, warehouse and office areas. American Laboratories is proud to be known as an industry leader and currently offers over 300 products to various industries including: Nutritional, Food, Diagnostic, Veterinary and Pharmaceutical and sell product to over 50 countries around the world.



QUESTIONS?

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