

The Natural Occurrence of Zinc Pyrithione (ZnPT) Antimicrobial

World's Most Popular Anti-Dandruff Agent

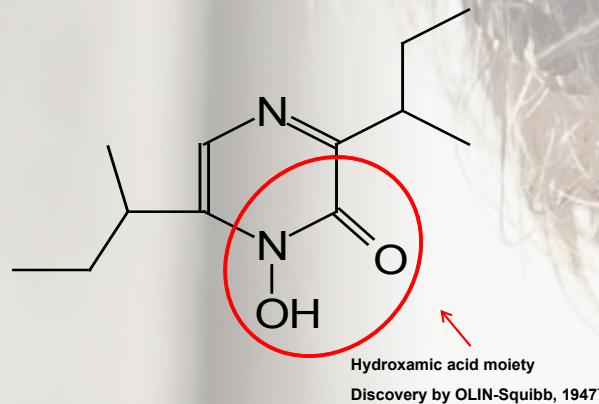
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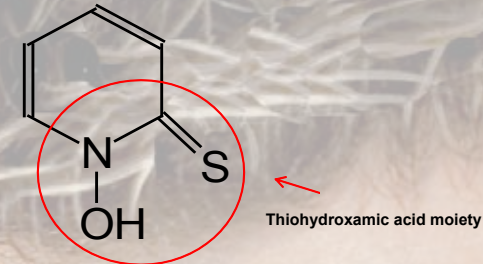
Pyrithione (PT)¹ molecule was first synthesized in 1947 by OLIN-Squibb chemists as a promising antibiotic drug candidate. To-day pyrithione compounds (sodium, zinc and copper) are used globally in preservation of fluids; as the “gold-standard” in anti-dandruff shampoos; and as the preferred TBTO replacement in marine antifouling paints; as well as mildewcides in wallboards, in-can and dry-film preservatives in architectural paints; and for odor control in textiles etc. because of their broad spectrum efficacy and proven ability to prevent the growth of microorganisms. Industrially produced PT antimicrobials have been successfully used for over 50 years. The most well known pyrithione, ZnPT, is a safe and effective OTC anti-dandruff drug active (recognized by USFDA as Category I, GRAS and GRAE). Many other unexploited applications like control of malaria parasite (*Plasmodium*)², treatment of nail fungus³, hand-sanitization etc. can only increase the potential of this molecule to protect and benefit mankind. Several scientific studies⁴ have shown that pyrithione compounds are non-persistent and degrade rapidly in the environment through biotic and abiotic pathways to non-toxic terminal metabolites that ultimately mineralize. In the past decade, there have been isolated reports⁵ from China that a certain plant that grows wildly in Hainan and Guangdong province (*Polyalthia nemoralis*) and used extensively as a herbal tea remedy for many human afflictions contains significant amounts of pyrithione compounds. This poster presents unequivocal evidence for ZnPT and other pyrithione compounds as active principles in the extracts from the roots of *Polyalthia nemoralis*. Pyrithione compounds have also been reported as minor constituents in extracts of other plant species such as *Allium stipitatum* Regel⁶ - an ornamental and edible plant in the garlic and onion family (used in everyday cuisine in Iran and Tajikistan, called “Persian shallot”) and in a New Zealand *Basidiomycete* (Mushroom) – *Cortinarius*⁷ species, thereby providing additional corroboration for the “Natural” occurrence of PT antimicrobials. The industrially produced and commercially sold ZnPT anti-dandruff active can therefore be considered “Nature Identical”.

Aspergillilic acid (a hydroxamic acid)

An antibiotic substance produced by *Aspergillus flavus*



Pyrithione (a thiohydroxamic acid)

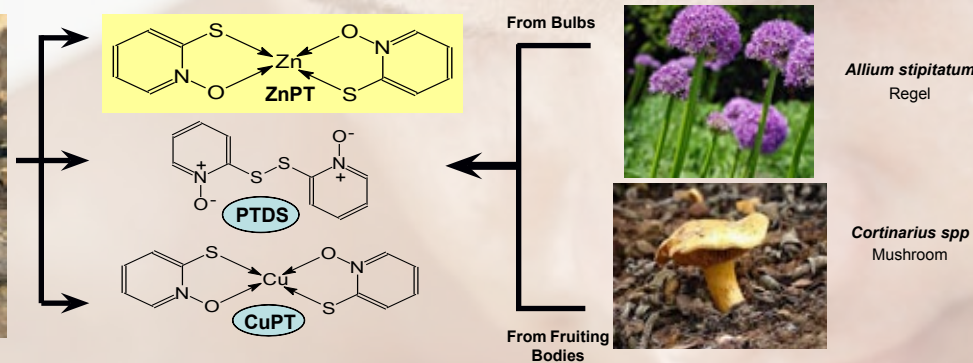


The antibiotic potential of aspergillilic acid prompted the Squibb researchers to synthesize a thiohydroxamic acid compound (parent compound – Pyrithione). While it did not show enhanced antibiotic properties, it exhibited broad spectrum anti-microbial activity vs. bacteria, fungi and yeasts

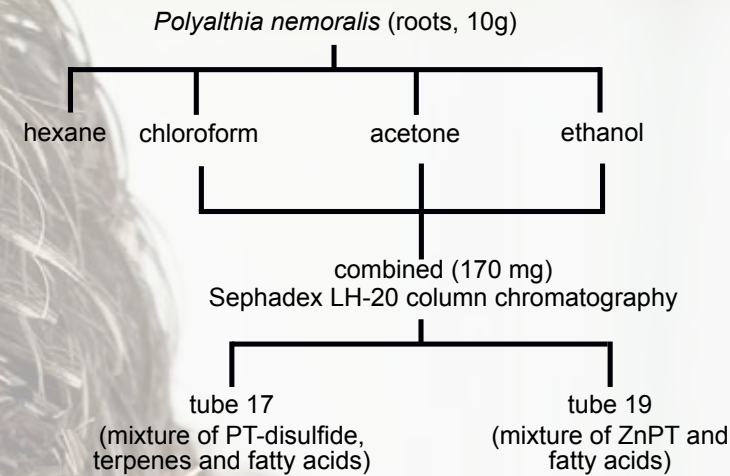
Polyalthia nemoralis - roots



Pyrithione compounds detected



Extraction Procedure

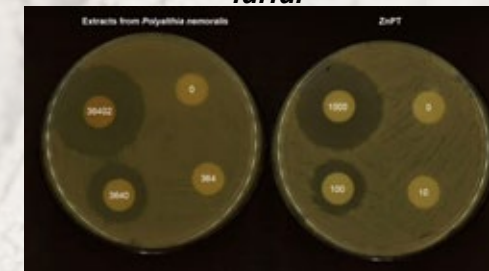


P. nemoralis extracts: Microbiology - MIC vs. ZnPT std.

Microorganism	<i>P. nemoralis</i> extract	ZnPT std
<i>Staphylococcus aureus</i> (6538)	39.1 (1.13)*	2.44
<i>Klebsiella pneumoniae</i> (4352)	78.1 (2.26)	2.44
<i>Pseudomonas aeruginosa</i> (9027)	625 (18.06)	39.1
<i>Pseudomonas aeruginosa</i> (15442)	1250 (36.13)	39.1
<i>Escherichia coli</i> (10536)	78.1 (2.26)	2.44
<i>Enterobacter gergoviae</i> (33028)	78.1 (2.26)	2.44
<i>Bacillus subtilis</i> (6633)	19.5 (0.56)	1.22
<i>Aureobasidium pullulans</i> (9348)	78.1 (2.26)	1.22
<i>Gliocladium virens</i> (9645)	313 (9.03)	19.5
<i>Penicillium pinophilium</i> (11797)	<4.88 (0.14)	<0.31
<i>Paecilomyces sp.</i>	156 (4.52)	9.77
<i>Malassezia furfur</i>	78.1 (2.26)	4.88
<i>LB penicillium sp.</i>	<4.88 (0.14)	<0.31
<i>Aspergillus niger</i> (16404)	313 (9.03)	4.88

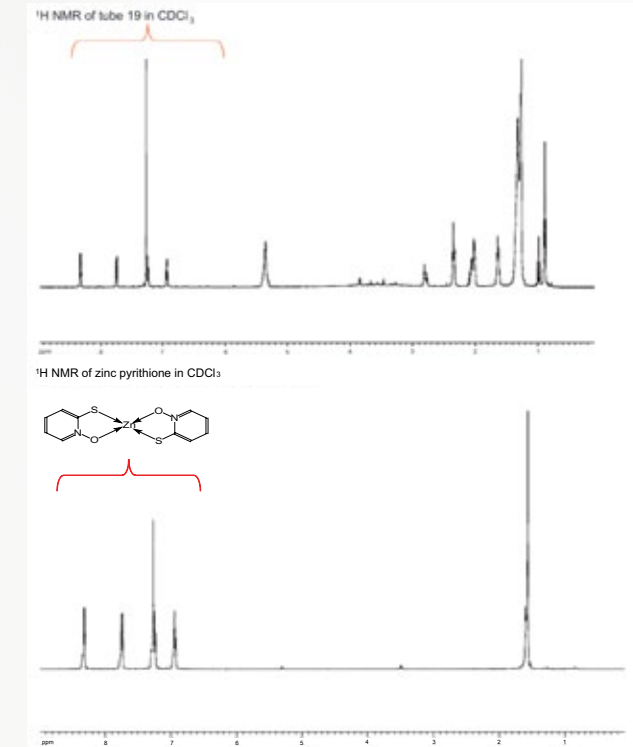
*Numbers in parentheses represent the concentration of the total pyrithione(s)

P. nemoralis extracts: Zone of Inhibition vs. *Malassezia furfur*



Metal Content (by GF-AA) in Extracts of <i>P. nemoralis</i>	
Zn (mg/g)	Cu (mg/g)
48.9	3.1

P. nemoralis extract: ¹H-NMR



21.4 mg of the enriched PT mixture can be obtained from 10 g of raw plant root material. ¹H-NMR, LC-MS, metal content, sulfur content unequivocally confirmed the presence of various pyrithiones including ZnPT. The purity was estimated to be approximately 50%, therefore PT compounds represent as 0.1% of the dried plant material.



Acknowledgements

The authors thank Dr. J. Yongcheng, Dr. M. Wu (Lonza-USA) and J. Zhang (Lonza-China) for translating the Chinese articles on *Polyalthia nemoralis* and Dr. Denise Taylor (Lonza-USA) for the literature search.

References

Handout available upon request

