piperonal from pepper

degradation of piperine

2002, by 3base

degradation of piperine preparation and properties of piperic acid hydrolysis of piperine to piperic acid and piperidine preparation of 5-(3,4-methylenedioxy phenyl)-2E,4E-pentadienoic acid (piperic acid) preparation of piperinic acid preparation of piperic acid further recipes and references

degradation of piperine

1g piperine and 10mL 10% alcoholic potassium hydroxide are refluxed for 90min. the ethanolic solution is evaporated to dryness under reduced pressure, the receiver being cooled in an ice-salt bath. the solid potassium piperinate is suspended in hot water and acidified with hydrochloric acid. the voluminous yellow percipitate is collected on a buchner funnel, washed with cold water, and recrystalized from ethanol to yield piperic acid as yellow needels of mp 216-217°C. the strongly basic ethanolic distillate in the receiver is saturated with hydrochloric acid and evaporated to dryness to give piperidine hydrochloride, which melts at 244°C after recrystallization from ethanol.

[<u>06</u>, page 236-238]

preparation and properties of piperic acid

the cleavage of piperine was accomplished with alcoholic KOH numerous experiments showed us that the following procedure is the most practical and gives almost the theoretical yield. in a roomy flask connected with an ascending

cooler a mixture of 1 part fine grinded piperine with 1 part KOH and 5 parts usual alcohol is boiled mildly about 24h in a water-bath.

in our experiments the decomposition was finished largely after 24h heating. after cooling the precipitation consisting of yellowish glossing leaflets was separated through a cheesecloth from the dark piperidine containing mother liquor, washed out with cold alcohol and recrystallized a few times from hot water under addition of animal coal. so the piperic acid potassium salt is obtained very easily pure in completely colorless, warty grouped prisms, that become again yellow colored at light. - the filtered acoholic mother liquor gives, if boiled 24h anew with one third of the prior applied KOH amount, another small amount of very impure, dark colored piperic acid potassium salt.

to obtail the free acid, the potassium salt was dissolved in about 50 parts boiling water, a small excess of hydrochloric acid was brought into the solution and the whole was heated for some time. the piperic acid was obtained as a lightish sulphur-yellow, amorphous, looser precipitation. ... after the washing and drying the acid was recrystallized from boiling alcohol. for the dissolution of 1 part piperic acid about 50 parts alcohol were required.

[<u>18</u>, page 27-29]

hydrolysis of piperine to piperic acid and piperidine

... place 1g of piperine and 10mL of a 10% solution of KOH in 95% ethanol in a 50mL round-bottomed flask. attach a condenser and heat at reflux for 90min. attach the flask to an apparatus suitable for distillation under reduced pressure. using an aspirator distill until dryness (1) and collect the distillate in an ice cooled receiver flask. scrape the residue into a 125mL erlenmeyer flask (use water to rinse material clinging to the sides of the round-bottomed flask). suspend the residue in a total volume of about 50mL of water, heat over a steam bath, and then acidify (in the hood) with hydrochloric acid. occasionally swirl the erlenmeyer flask. collect the voluminous yellow precipitate of piperic acid by suction filtration, wash with cold water, and recrystallize from hot ethanol (2).

note the odor of the distillate. check the distillate with litmus or pH paper (3).

(1) bumping may occur at this step.

(2) the yield of crude piperic acid is high. the melting point of the recrystallized acid is 214-215°.

(3) the hydrochloride salt of piperidine may be isolated ...; however we have found this to be difficult and probably not worth the effort.

[<u>01</u>, page 528]

preparation of 5-(3,4-methylenedioxy phenyl)-2E,4E-pentadienoic acid (piperic acid)

piperine (28.0g, 98mmol, mp 132°C) dissolved in 200mL ethylene glycol and refluxed at 180°C after adding 25g potassium hydroxide and after the completion of the reaction the contents diluted with sufficient amount of water and acidified with 2N HCI. the resulting precipitate filtered and dried to give crude product which on crystallisation from ethanol gave piperic acid (13.8g, 65%, mp 217°C) as pale yellow solid (lit. mp 217°C).(27)

(27) dictionary of natural products 1994 4 3920; chapman, hall

[<mark>03</mark>]

preparation of piperinic acid

to piperine (2g, 0.7mmol, 1eq), 20% of methanolic KOH (100mL) was added and refluxed for 2days. after completition of the hydrolysis, methanol was removed under reduced pressure and a yellow coloured oily solid was obtained. this residue was dissolved in 50mL water and acidified with 6N HCl to pH<1 yielding a yellowish percipitate of piperinic acid. recrystallization from methanol gave yellow needles (0.9g, 60% yield)). mp 206°-208°C (lit mp 217°-218° (1))

(1) tetrahedron 1967 23: 1769-1781
"alkaloids of piper longum linn-I structure and synthesis of piperlongumine and piperlonguminine"
a.chatterjee, c.p.dutta

[02, page 69(60), 76(67)]

preparation of piperic acid

in a 1L round-bottom fask was placed 6g piperine, 500mL ethanol and 100mL aqueous LiOH 90g/L solution. the resultant solution was refuxed for 140h, and the reaction was then quenched by addition of 35mL concentrated hydrochloric acid. the solid formed was removed by filtration and recrystalized from THF to produce piperic acid in 85% yield, mp 126-127°C.

[<u>09</u>]

(mp 126-127°C looks like an error. it seems that 1 and 2 are permuted. other papers report mp 216-217°C. also 140h sounds extremely long [3base])

further recipes and references

piperic acid - beilstein/crossfire search as product

degradation of piperine to piperic acid with KOH in MeOH/H2O (german)

hydrolysis of piperine to piperic acid [26, (2)]

hydrolize with NaOH in alcohol. (MeOH/EtOH both verified) [27]

hydrolysis of piperine to piperic acid and piperidine [28]

piperine ... alkaline hydrolysis ... 2N KOH in diethylene glycol and reflux 2h [29]

the present invention relates to a preparation technology of piperic acid ... which uses pepper or piper longum ... [34]

references

[01]

"laboratory experiments in organic chemistry" 3.edition 1979 jerry r. mohrig, douglas c. neckers d. van nostrand company, new york ISBN 0-442-25471-7

[02] patent <u>GB2370989</u>, 2002-07-17 **"piperine analogues for the treatment of skin conditions"** VENKATASAMY RADHAKRISHNAN, RAMAN AMALA, HIDER ROBERT CHARLES BTG INT LTD <u>page 69(60)</u>

[03]

bioorganic & medicinal chemistry 2000 8(1): 251-268 "structure–activity relationship of piperine and its synthetic analogues for their inhibitory potentials of rat hepatic microsomal constitutive and inducible cytochrome P450 activities" Surrindera Koul, Jawahir L.a Koul, Subhash C.a Taneja, Kanaya L.a Dhar, Deshvir S.b Jamwal, Kuldeepb Singh, Rashmeet K.b Reen, Jaswantb Singh

[06]

"natural products - a laboratory guide" 2.edition 1991 raphael ikan; academic press, inc; ISBN 0-12-370551-7

[09]

pest management science 2000 56(2): 168-174

"synthesis and insecticidal activity of new amide derivatives of piperine" vanderlúcia fde paula, luiz c de a barbosa, antônio j demuner, dorila piló-veloso, marcelo c picanço

abstract: the natural lipophilic amides piperine and piperiline were isolated from piper nigrum I (piperaceae). piperine was hydrolysed into piperic acid (85% yield) which was converted into 16 amides (28-89% yield). the contact toxicity of all synthetic amides, and also that of piperine and piperiline, at the dose 10 µg per insect, was evaluated for the brazilian economically important insects ascia monuste orseis latr, acanthoscelides obtectus say, brevicoryne brassicae I, protopolybia exigua de saus and cornitermes cumulans kollar. the results demontrated that the insects have different sensivities to the various amides, with mortality ranging from 0 to 97.5% according to the compound and insect species.

[18]

analen der chemie und pharmacie 1869 152: 25-58

"untersuchungen ueber die constitution des piperins und seiner spaltproducte piperinsaeure und piperidin - erste abhandlung" rud fittig, w h mielck

[26]

(1) piperine from black pepper (2) hydrolysis of piperine to piperic acid http://www.rhodium.ws/chemistry/piperine.txt

[27] <u>"piperine to piperonal procedure"</u>, the cook http://www.rhodium.ws/chemistry/piperine.txt

[28]

"piperonylic acid from black pepper" "laboratory experiments in organic chemistry", page 527 mohrig, neckers http://www.rhodium.ws/chemistry/piperine.txt

[29] <u>j agric food chem 1966 14(5): 469-472</u> "ANALYTICAL METHOD - Determination of the Pungent Constitueints of Piper nigrum" BART LABRUYERE

[34]
 patent <u>CN1298936</u>, 2001-06-13
 "process for preparing health-care peperic acid wine"; li yueting
 <u>abstract:</u> the present invention relates to a preparation technology of piperic-acid

health-care wine which uses pepper or piper longum as raw material, and it is extracted and mixed with wine to obtain the product which not only possesses wine flavour, but also possesses the medicinal health-care active of pepper or piper longum. it can prevent the rise of blood serum cholesterol and formation of choleithiasis.