A device and a method for separating fish liver
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The invention relates to a device for separating fish liver from other fish viscera, comprising a container with side wall, bottom and a top with a top wall, a viscera inlet for fish viscera including liver, an outlet for liver and liquid in the top of the container and optionally a separate liquid inlet, which container has an inner volume in which fish liver is separated from other viscera.

The invention also relates to a method for separating fish liver from other fish viscera, whereby fish viscera including liver is fed into a liquid-filled container with side wall, bottom, a top with a top wall, a liquid inlet and an outlet placed high up for liver and liquid.

Fish liver from for instance codfish is a sought-after part of the fish, which can be used for a number of purposes such as consumption and extraction of fish oil or liver oil. Therefore, it is a wish in connection with the processing of fish to free the liver from other viscera to provide pure liver. Large fish are often gutted manually, whereby the liver can be separated undamaged. Smaller fish are often gutted mechanically, e.g. by a machine that brushes the viscera out of the belly after this has been cut open. Thereby a portion of viscera is provided comprising all the viscera including the liver.

The object of this invention is to provide a device and a method, whereby the liver in such a portion of viscera can be separated from the other viscera in a careful but effective manner.

A device for the separation of liver from viscera from gutted fish in a liquid medium is known from SU-A-I 321 394, which device comprises a container with side walls, a bottom, a top with a top wall, a loading unit in the top, a mechanical unit including three rotors for the separation of liver from waste placed immediately below the loading unit, the top wall is provided by an inverted-funnel-shaped lid including a liver collecting tank, an accumulator and a confluence pipe. At the bottom of the container, a device is provided for compression and reduction of the volume of the container, whereby liquid in the container can be pressed up into the liver-collecting tank and out through the confluence
pipe carrying with it liver, which is thus conveyed along the top wall. In
the bottom of the container, a cell sluice for leading away waste is pro-
vided. Using this device, the viscera including liver will be exposed to a
considerable mechanical influence from the three rotors, an influence
which is undesirable according to the present invention. The rotors are
placed so that they practically sweep the whole section of the container
in two levels, and together they sweep approximately half the volume of
the container.

US-A-719 948 discloses a device for separating the hulls and meat
of cotton seeds. The device comprises an upwardly open container con-
taining liquid (water). Thus there is no top wall. Within the container
there is an inner volume in which the separation of shells and insides
takes place. This inner volume is confined between a conveyor, an
oblique plate and a trough in the container which functions as a water
inlet. Apart from carriers on the conveyor, the inner volume is free of
mechanically stirring elements.

The object of the present invention is thus met by a device of the
type mentioned by way of introduction which is characteristic in that the
inner volume is substantially free of mechanically stirring elements, so
that a maximum of 1/3, preferably 1/4 and further preferably 1/5 of the
inner volume wherein fish liver and other viscera are separated is swept
by mechanically stirring elements. Hereby, a device is obtained in which
liver can be separated effectively from viscera, largely without influence
from mechanical elements that might damage the liver more than it
may already be from the fish-gutting machine. Preferably, conveying
means are provided to convey liver along the top wall towards the out-
let. Because of the top wall, the container can be used constantly filled
with liquid, which means that the device can be used on a ship in open
sea, as the liquid in the container will not be able to splash out. Prefera-
bly, sea water is used as liquid.

In a preferred embodiment, the top wall has a flat concave shape,
the outlet is situated in the top wall at the highest point, the viscera
inlet is situated in the top wall and is equipped with an inlet funnel, and
means are provided for the conveyance of liver along the top wall to-
wards the outlet.

In this preferred embodiment, the top wall preferably has a section which extends, substantially horizontally, from the viscera inlet to the outlet. Thereby it is achieved that loading can easily be carried out by viscera being loaded into the inlet funnel, and that pieces of liver are easily conveyed to the outlet.

The means for conveying liver along the top wall preferably comprise means for providing a flow of liquid along the top wall. Such a flow of liquid has been shown to be well-suited to overcoming friction between the rising liver and the top wall. This friction can otherwise prevent the pieces of liver from moving towards the outlet, once they have risen to the top wall due to their buoyancy.

In a preferred embodiment, the means for providing a flow of liquid along the top wall comprise at least one nozzle situated in the container and pointing towards the top wall and the outlet. With one or preferably several of such nozzles, a jet can be projected against the top wall, which jet is deflected after encountering the top wall and continues towards the outlet. The at least one nozzle is preferably mounted on a pipe that extends within the container.

The top wall is preferably comprised by an openable tight-fitting lid. Thereby, easy access to the container is provided for cleaning and maintenance.

Alternatively, or as a supplement to the viscera inlet in the top of the container, a viscera inlet can be situated in the side wall of the container and be designed for connection to a feed pump. Thereby it is possible to pump viscera including liver into the container some distance below the top.

Preferably, a conveyor extends along the bottom to remove viscera from which liver has been separated, said conveyor preferably extending past a sharp edge for separation of liver from other viscera. Thereby it is made possible to continuously remove the other viscera during operation of the device, and any pieces of liver that might be stuck to other viscera and be held down by these can be freed at the edge and rise upwards in the container towards the outlet.
The object of the invention is also met by a method of the type mentioned by way of introduction, which is characteristic in that fish viscera are introduced into an area within the container which is free of mechanically stirring elements, whereby buoyancy and the flow of liquid conveys liver to the outlet for liver, and the force of gravity causes other viscera to precipitate.

In the following, the invention will be explained in more detail by way of an example of an embodiment with reference to the accompanying drawings, in which

fig. 1 shows a sectional view through a device according to the invention as indicated by I-I in fig. 2,

fig. 2 shows the device in fig. 1 viewed in the direction of the arrow II in fig. 1, and

fig. 3 shows a sectional view along the line III-III in fig. 1.

The drawings show a device for separating fish liver from other viscera removed from fish during the gutting of these. The device comprises a container with an inner volume 1, side wall 2, bottom 3 and top 4. The side wall comprises two sides 5, a front wall 6 and a rear wall 7. The bottom 3 comprises a longitudinal, central trough 8 and two oblique sections 9, one on either side of the trough 8. The top 4 comprises a lid 10 that can be opened and closed, which fits tightly against the side wall at a commissure 11. The lid 10 comprises a top wall with a flat, concave shape, viewed from the inside of the container, the top wall being formed by two oblique sheets 12 that meet as a roof in a ridge 13.

In the lid 10 there is viscera inlet 14 in the form of an opening in the lid, with an inlet funnel 15, and an outlet 16. Both viscera inlet 14 and outlet are situated by the ridge 13. The outlet is in the form of a pipe which extends up from the lid 10, to the side and obliquely downwards to a downward-facing exit aperture 17, as can be seen in figs. 2 and 3.

A conveyor with a conveyor belt 18 with carriers 19 extends in the central, longitudinal trough 8. The conveyor extends along the oblique front wall 6, over the height of the outlet 16 and out of the container 1. Along the oblique front wall 6, the conveyor extends behind a partition
wall 20, which has a sharp lower edge 21, which the carriers 19 pass by with close proximity when the conveyor 18 is in motion. In the rear wall 7 by the trough 3 there is a cleaning hatch 22.

In the rear wall 7, there are two pipe connections for the connection of water supply and another viscera inlet 24 designed for connection to a feed pump (not shown). A pipe 25 with nozzle openings dispersed along its length extends right through the container 1 from side 5 to side 5. The nozzle openings are situated in the wall of pipe 25 so that jets of liquid can be directed towards the lid 10 and the outlet 16 as shown by arrows 26, in order to provide a flow (arrow 27) along the lid 10 towards the outlet 16. The pipe 25 has a pipe connection 28 for connection to a water supply.

The container 1 has legs 29, of which at least some 29a are adjustable, e.g. with a winding handle 30, so that the container 1 can be placed with ridge 13 positioned horizontally. For the sake of simplicity, the legs are only shown schematically in fig. 1.

The device functions as follows:

The container 1 is filled with liquid, preferably sea water, through pipe connections 23 and 28. When the container 1 is full, the water will start to run out of the outlet 16. At that time, the water will be at a level a little into the inlet funnel 15 and behind the partition wall 20, as shown by water surfaces 31.

Viscera taken out of fish are fed into the inlet funnel 15, using means not shown, and sink into the water in the inner volume I a of the container. The water in the inner volume I a circulates calmly due to the continuous inflow of water through pipe connections 23 and 28, and the movement in the water, combined with gravity and the buoyancy of the water, cause the pieces of liver among the viscera to separate from the other viscera and rise towards the lid 10, while the remaining viscera sink towards the bottom 3.

Due to the continuous supply of water, there is a flow of water through the outlet 16, which flow carries with it pieces of liver as they reach the outlet 16. Pieces of liver which during their rising reach the lid 10 tend to remain where they meet the lid 10 due to friction. Therefore,
conveyance of pieces of liver along the lid is provided by means of the flow 27, which is created because of the jets of water 26 being emitted from the pipe 25.

The pieces of liver that are lead out through the outlet 16 by the water flowing out can be separated from the water after having passed the exit aperture 17 using a screen (not shown), for example in the form of a perforated conveyor belt that can carry the pieces of liver on to collection.

Due to the oblique sections 9, the remaining viscera, which sink to the bottom, will end up on the conveyor belt 18, which is situated outside the inner volume of the container 1 where the separation of liver and other viscera takes place. These other viscera are carried up along the oblique front wall 6 by the conveyor belt 18 and out of the container 1 for collection. Any pieces of liver that might be stuck to the other viscera and have been dragged to the bottom by these will stick up from the conveyor belt and, when they reach the sharp edge 21, will be separated from the other viscera that they are stuck to, after which these pieces of liver can also rise up to the outlet.

The device disclosed herein has been shown to work, also aboard fishing vessels in open sea. During loading of a fishing vessel, which can be done from fore to aft or the other way around, the inclination of the vessel is changed, and consequently the inclination of the device has to be adjusted using the adjustable legs 25a, so that the lid 10 and its ridge 13 continue to have the correct inclination close to horizontal.

In the embodiment disclosed here, the inner volume 1a, in which the separation of pieces of liver from the other viscera takes place, is completely free of mechanically stirring elements. However, according to this invention it is not precluded to provide mechanical elements that can aid the water circulation provided by the inflowing water, when such mechanical elements do not substantially interfere with the viscera including liver that is fed into the container.

This invention is not limited to the embodiment shown and disclosed herein. For example, only the one viscera inlet could be provided. If only the other viscera inlet 24 with a pump connection were provided,
the container could be designed with a top wall that sloped up towards the outlet in such a way that it would not be necessary to provide further means for the conveyance of pieces of liver along the under side of the top wall.

Furthermore, in connection with the shown embodiment of the container other means are conceivable for conveyance of pieces of liver along the under side of the top wall than the above-mentioned flow provided by the nozzles in the side of the pipe 25.
C L A I M S

1. A device for separating fish liver from other fish viscera, comprising a container with side wall, bottom and a top with a top wall, a viscera inlet for fish viscera including liver, an outlet for liver and liquid in the top of the container and optionally a separate liquid inlet, said container having an inner volume in which fish liver is separated from other viscera, said inner volume (Ia) being substantially free of mechanically stirring elements, so that a maximum of 1/3, preferably 1/4 and more preferably 1/5 of the inner volume in which fish liver and other viscera are separated is swept by mechanically stirring elements.

2. A device according to claim 1, in which conveying means are provided for transporting liver along the top wall towards the outlet.

3. A device according to claim 2, in which the top wall has a flat concave shape, viewed from the inside of the container, the outlet is situated in the top wall at the highest point, and the viscera inlet is situated in the top wall and is fitted with an inlet funnel.

4. A device according to claim 3, in which the top wall has a section that extends substantially horizontally from the viscera inlet to the outlet.

5. A device according to any of the claims 2 to 4, wherein the conveying means for conveyance of liver along the top wall includes means for providing a flow of liquid along the top wall.

6. A device according to claim 5, characterized in that the means for providing a flow of liquid along the top wall includes at least one nozzle situated within the container and aimed at the top wall and outlet.

7. A device according to claim 6, wherein the at least one nozzle is mounted on a pipe which extends within the container.

8. A device according to any of the claims 1 to 6, in which the top has an openable tight-fitting lid.

9. A device according to any of the claims 1 to 8, in which a viscera inlet is located in the side wall of the container and is designed to be connected to a feed pump.

10. A device according to any of the claims 1 to 9, wherein a con-
veyor extends across the bottom to remove viscera from which liver has been separated, said conveyor extending past a sharp edge for separation of the liver from other viscera.

11. A method for separating fish liver from other fish viscera, whereby fish viscera including liver is fed into a liquid-filled container having side wall, bottom, a top with a top wall, a liquid inlet (23; 24; 25) and an outlet (16) placed high up for liver and liquid, whereby the fish viscera are fed into an area of the container that is free of mechanically stirring elements, whereby buoyancy brings pieces of liver to the outlet for liver, and gravity brings the remaining viscera to precipitate.