of the capital expenditures over the operating expenditures (capex/opex). It is an object to provide a process and apparatus that may be easier to clean and maintain. It is an object to provide a process and apparatus that does not lead to decomposition nor any other substantial modification of the properties of the polymer to be devolatilised.

SUMMARY

The present disclosure thereto provides a devolatilization apparatus for removing volatiles from a polymer melt feed, the apparatus comprising:

- a devolatilization nozzle comprising an inlet part, a polymer distribution part comprising headers, and an outlet part comprising a number of apertures, configured to form polymer strands in a devolatilization vessel;
- a collector, configured to collect the polymer strands in the devolatilization vessel;
- a polymer outlet, configured to remove the collected polymer from the collector; and,
- a gas outlet, configured to remove the volatiles from the devolatilization vessel;

preferably characterized in that

the average aperture diameter is at least 0.5 mm and at most 8.0 mm; and,
the strand drop height is at least 1.0 m and at most 20.0 m.

In one aspect, the present disclosure thereto provides a devolatilization apparatus for removing volatiles from a polymer melt feed, the apparatus comprising:

- a devolatilization nozzle comprising an inlet part, a polymer distribution part comprising headers, and an outlet part comprising a number of apertures, configured to form polymer strands in a devolatilization vessel;
- a collector, configured to collect the polymer strands in the devolatilization vessel;
- a polymer outlet, configured to remove the collected polymer from the collector; and,
- a gas outlet, configured to remove the volatiles from the devolatilization vessel;

characterized in that

the average aperture diameter is at least 0.5 mm and at most 8.0 mm;
the average distance between adjacent apertures is at least 4.0 mm and at most 6.0 mm; and,
the strand drop height is at least 4.0 m and at most 20.0 m.

In some preferred examples, the average aperture diameter is at least 1.0 mm and at most 6.0 mm; more preferably is at least 1.5 mm and at most 4.0 mm; most preferably about 2.0 mm.

In some preferred examples, the strand drop height is at least 2.0 m and at most 10.0 m; more preferably at least 4.0 m and at most 8.0 m; most preferably about 6.0 m.

In some preferred examples, the average distance between adjacent apertures is at least 2.0 and at most 12.0 mm; preferably at least 2.5 and at most 10.0 mm; more preferably at least 3.0 and at most 6.0 mm; most preferably about 4.0 mm.

In some preferred examples, the apertures are arranged in a triangular grid.

In some preferred examples, the apertures are tapered apertures created by a water jet.

In some preferred examples, the apparatus is configured such that the polymer melt viscosity at the inlet part and/or at the temperature T at the inlet part is at least 100 000 cP

and at most 5 000 000 cP; preferably at least 200 000 cP and at most 2 500 000 cP; preferably at least 500 000 cP and at most 2 000 000 cP; more preferably at least 750 000 cP and at most 1 500 000 cP; most preferably about 1 000 000 cP.

In some preferred examples, the apparatus is configured such that the average throughput per aperture is at least 5 g/h and at most 100 g/h; preferably at least 10 g/h and at most 75 g/h; more preferably at least 20 g/h and at most 50 g/h; most preferably about 25 g/h.

In some preferred examples, the apparatus is configured such that the ratio of polymer viscosity at the inlet part and/or at the temperature T at the inlet part / average aperture diameter is at least 50 000 cp/mm to at most 4 000 000 cp/mm; preferably at least 60 000 cp/mm to at most 2 500 000 cp/mm; preferably at least 80 000 cp/mm to at most 1 500 000 cp/mm; preferably at least 150 000 cp/mm to at most 1 200 000 cp/mm; preferably at least 200 000 cp/mm to at most 1 000 000 cp/mm; preferably at least 400 000 cp/mm to at most 600 000 cp/mm, preferably around 500 000 cp/mm.

In some preferred examples, the apparatus is configured such that the ratio of strand drop height / average aperture diameter is at least 00.5 m/mm to at most 6.0 m/mm; preferably at least 1.0 m/mm to at most 5.0 m/mm; preferably at least 2.0 m/mm to at most 4.0 m/mm; preferably about 3.0 m/mm.

In some preferred examples, the apparatus is configured such that the ratio of average distance between adjacent apertures / average aperture diameter is at least 0.5 to at most 10.0; preferably at least 1.0 to at most 5.0; preferably at least 1.5 to at most 4.0; preferably about 2.0.

In some preferred examples, the apparatus is configured such that the ratio of average throughput per aperture / average aperture diameter is at least 2.0 g/h/mm to at most 50.0 g/h/mm; preferably at least 5.0 g/h/mm to at most 30.0 g/h/mm; preferably at least 10.0 g/h/mm to at most 15.0 g/h/mm.

In a further aspect, the present disclosure thereto provides use of the devolatilization apparatus as described herein , for reducing volatiles in a polymer melt feed.

The present disclosure thereto provides a process for reducing volatiles in a polymer melt feed, comprising the steps of:

- providing a polymer melt feed to a devolatilization apparatus as described herein, or examples thereof;
- passing the polymer melt feed through the apparatus, thereby forming polymer strands in a devolatilization vessel;
- collecting the polymer strands in a collector by letting the polymer strands drop over a strand drop height into the collector; thereby obtaining a devolatilised polymer in the collector and removed volatiles;
- recovering the volatiles through a gas outlet of the devolatilization vessel; and,
- recovering the resulting devolatilised polymer from the collector through a polymer outlet of the collector.

In a further aspect, the present disclosure thereto provides a process for reducing volatiles in a polymer melt feed, comprising the steps of:

- providing a polymer melt feed to a devolatilization apparatus as described herein;
- passing the polymer melt feed through the apparatus, thereby forming polymer strands in a devolatilization vessel;
- collecting the polymer strands in a collector by letting the polymer strands drop over a strand drop height into the collector; thereby obtaining a devolatilised polymer in the collector and removed volatiles;
- recovering the volatiles through a gas outlet of the devolatilization vessel; and,
- recovering the resulting devolatilised polymer from the collector through a polymer outlet of the collector;

preferably wherein the polymer melt viscosity is at least 100 000 cP and at most 5 000 000 cP and the average throughput per aperture is at least 5 g/h and at most 100 g/h.

In some preferred examples, the polymer melt viscosity at the inlet part and/or at the temperature T at the inlet part is at least 100 000 cP and at most 5 000 000 cP; preferably at least 200 000 cP and at most 2 500 000 cP; and the average throughput per aperture is at least 5 g/h and at most 100 g/h.

The present disclosure thereto provides a devolatilised polymer, obtained through a process as described herein, and examples thereof, or with an apparatus as described herein, and examples thereof. The devolatilised polymer preferably comprises a residuals concentration of volatiles at the outlet of at most 3 000 ppm.

The present disclosure, and examples thereof, provides an improved process for reducing volatiles in a polymer melt feed, for example in a second step devolatilization, and an improved apparatus for removing volatiles from a polymer melt feed, for example in a second step devolatilization.

The polymer degassing is very efficient. The polymer distribution inside the nozzle is particularly optimised for efficient degassing. Furthermore, disadvantages of other stripping methods are avoided, swelling is minimised, and the strands are more stable.

The polymer degassing may be so efficient that there is no need for the use of blowing agents or for expanding the polymer during the degassing process, resulting in un-expanded polymer. Processes for degassing polymers without producing expanded polymers may be favourable as they do not require an extra melt step to obtain degassed un-expanded polymer.

Being able to work at optimised aperture diameters allows for simpler engineering, lower capex and opex.