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THE OPTIMIZATION OF THE COARSE BREAK SEPARATION IN WHIRLPOOL DURING BEER BREWING

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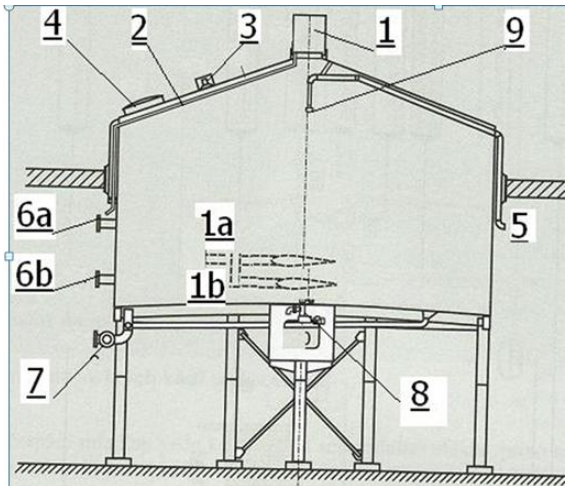
Abstract. *The paper is focused on optimization of the coarse break separation. The coarse break hinders wort clarification, increases the amount of break – rich sediment and thereby increases the losses, causes final filtration of beer very difficult. The amount of coarse break is about 6 000 – 8 000 mg/l, after its separation should decrease under 100 mg/l. In the past the coarse break used to be separated in a coolship or settling tank, but nowadays are frequently used whirlpool yet reliably tested.*

Key words: *beer, Wort, coarse break, separation, whirlpool.*

The wort is semi-product for beer production, after mashing and having boiled with the hops consists of large particles in size 30 – 80 μm in size, which are slightly heavier than the wort and in general settle down to create a compact mass, so called coarse break or break trub, which must be separated because it is of no value for beer production, but also detrimental to its quality. For separation of coarse break are used Whirlpool, vertical cylindrical vessel designed according to the invention of A. Einstein, who as a first one di (tea-cup effect). Whirlpool is not equipped with any internal fittings that may cause some microbiological contamination. The wort is pumped to the Whirlpool by tangentially designed, depending on the size of vessel one or two nozzles. Due to tangentially inlet wort inside the whirlpool starts to rotate, generated centrifugal force brings heavier particles as a wort towards the wall.



Picture 1 - **Diagram of Whirlpool:**

1a – Upper tangential inlet DN32; 2 – Lower tangential inlet DN32; 2 – outlet of condensed water from chimney; 4 – manhole; 5 – inlet of CIP (cleaning) agent; 6a – upper outlet of cleared wort DN32; 6b - outlet of cleared wort DN32; 7 – outlet of coarse break; 8– lower cleaning head; 9 – upper cleaning head

When the speed of rotation slows down, a another generated force, centripetal one, brings the particles of coarse break on the contrary from the wall back to the centre of vessel where they form a rigid cone. There are, of course, some another theories for phenomena of cone generation, but above used description is the simplest and the most comprehensible one. For the optimization of the coarse break separation during beer brewing was used Whirlpool installed in Tutorial and Research Brewery of CULS. The volume of Whirlpool was 0,91 m^3, diameter was 1,1 m, height 1,2 m, the original extract of the wort was 2%., it corresponds density 1,05 g/cm^3. For transport of cloudy wort was used centrifugal pump Ebara Type equipped with frequency converter. The experimental activity included measurement of coarse break before and after separation of coarse break using calibrated Imhoff cone with the scale. The frequency converter controlled speed of wort flow from hops kettle to the Whirlpool in range 15 to 30 minutes The statistical average of ten measurements figures is given in Table No 1.

Table 1

Measured figures from separation of coarse break using a Whirlpool

No	Time of pumping /Minutes/	angular velocity /rad/s/	centrifugal force /N/	separation coarse b. start %	separation coarse b. finish %	Efficiency separation %
1	15	2,29	3028,4	8,5	1,2	7,1
2	18	1,9	2085,1	8,5	2,7	3,1
3	21	1,63	1534,3	8,5	4,2	2,1
4	24	1,43	1181,1	8,5	5,5	1,5
5	30	1,14	751,1	8,5	8,1	1,04

After evaluating the measured data given in Table No. 1, it is clear that the optimal separation parameters are achieved at the inflow time 18 - 21 minutes, because for the subsequent fermentation the presence of part of the coarse break is necessary to support function of the yeast. This break contains also long chained fatty acids needed for the building up of the yeast membrane.

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