

Yeast management in whisky distilleries

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Abstract:

While the distilling industry is making great strides forward in scales of economy and technical advances, there have been a number of issues within the distilling industry in general that are poorly understood and communicated. One of these issues is the manner in which distillers manage their yeast in terms of supply, handling and husbandry. In an attempt to gain an insight into the actual yeast management in whisky distilleries we formulated a questionnaire that was sent to all whisky distilleries in the UK, Ireland, USA and Canada. Most distilleries purchased their yeast from a third party, while only the American distilleries used their own proprietary yeast strains. In general, it could be observed that large distilleries would have their yeast supplied as yeast-cream, while most others used pressed yeast cakes. While traditionally reported to be the case; none of the responding distilleries used yeast that came from a brewery. Most small and medium sized distilleries had no, or very limited ability to carry out any sort of analyses on the yeast when it arrived at the distillery – let alone just prior to pitching. Most distilleries relied on the specification provided by the third party supplier. The vast majority of the distillers did not carry out any form of yeast propagation, furthermore aeration of either the yeast or the wort occurred only very rarely.

Key words:

whisky, yeast management, yeast husbandry, yeast supply, distillery

Introduction:

The production of whisky is typically shrouded in a mist of mystery, with perceptions of difficult to reach places where once an illicit still stood, and the ultimate product handcrafted with meticulously polished rough edges. Some distilleries are probably on or near a spot where such an illicit still once stood. Most malt distilleries are working hard to preserve this perception: wooden washbacks, stacks of crumbling peat near a disused kiln, and copper-bellied potstills is what sells whisky! However, many modern operations behind the visitor centres are more like chemical engineering plants, where energy efficiencies and yield are among the most important issues to the plant manager.

When it comes to biological sciences and technologies that are used in the optimisation and understanding of the mashing and fermentation processes, the distillery industry borrows many leaves out of books from the brewing industry. While there are now many parallels in scientific and engineering application between the brewing and distilling industries, remarkably little is known about yeast handling and management in distilleries. There are numerous texts available that describe how yeast is best handled in a brewery environment, however there is a deafening quite when it comes to texts that provide any insight into the management and husbandry of yeast in whisky distilleries. This work entails a survey that was conducted among whisky distilleries in Scotland, Ireland, Canada and the USA in 2008. The aim of the survey was to provide an insight into the supply, handling and management of yeast in the commercial whisky industry.

Experimental:

Survey

In September 2008, a questionnaire was send out to every registered whisky distillery in the UK, Ireland, Canada and the USA. Approximately 120 forms were send out in a “cold-calling” manner, of which about 20 returned unopened, while 35 questionnaires returned fully filled out.

The questionnaire did not require to respondent to identify the distillery, brand or specific location of distillery. All returned questionnaires were unidentifiable.

Outcomes and Interpretation

Yeast supply

The yeast required to facilitate the fermentation of the wort is often supplied to the distillery from a third party. While in a distant past, many distilleries obtained their yeast from a nearby brewery; this survey found that none of the respondents obtained their yeast from a brewery.

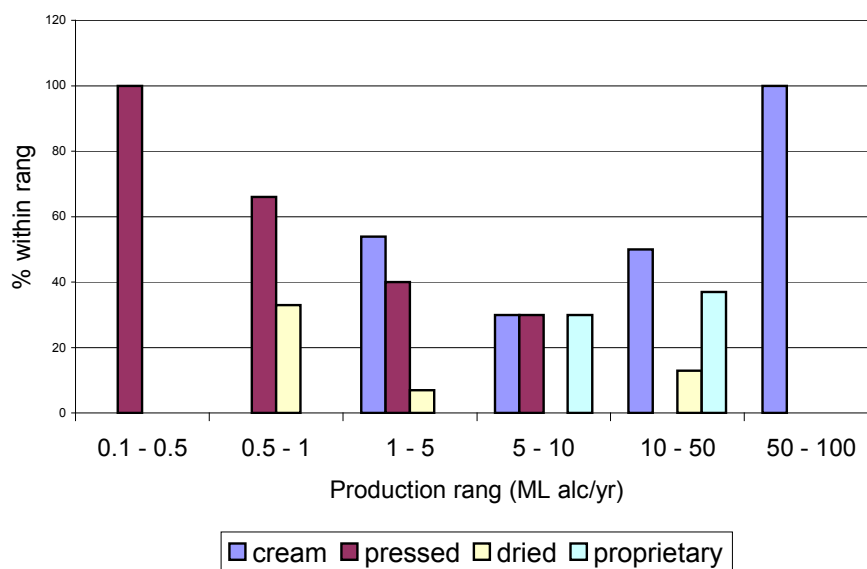


Figure 1. Yeast supply to distilleries

The survey showed that smaller distilleries were using pressed yeast; while the larger distilleries all used cream yeast. The use of active dried yeast was rare; while only the Bourbon distilleries were using their own proprietary yeast strains. Only two of the respondents used more than one, third party supplied yeast strains.

The vast majority of distilleries receiving either pressed or cream yeast from a third party supplier had their yeast supplied to site approximately once a week. Eight % of the respondents indicated that they had NO agreement in place with their supplier with regards to temperature during transport to their distillery. Approximately 50% of the distilleries had some arrangement in place with regards to allowable bacterial levels/contamination in their yeast, or yeast viability at the time of supply. The other 50% had no specific arrangement, or were not aware of such arrangement (Fig. 2).

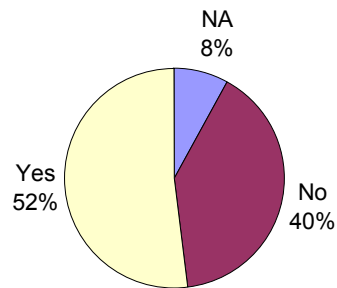


Figure 2. Supply arrangements with regards to yeast viability

“No” means no specific specifications with regards to the presence of bacteria up on supply of the yeast to site. “Yes” means that there were specific specifications with regards to the presence of bacteria up on supply of the yeast to site. “NA” means that the respondent was not aware of any specific specifications.

On-site storage of yeast

The vast majority of distilleries had refrigerated storage for their yeast. Only 3 distilleries indicated that they stored their yeast under “ambient” conditions. Storage under ambient conditions included storage of active, dried yeast.

Quality Assurance Facilities

All large distilleries (those distilling by means of continuous distillation, as compared to the smaller ones that distill by means of pot stills in batch mode) had on-site laboratory facilities.

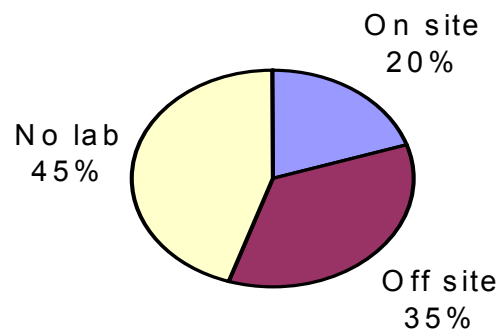


Figure 3. Presence of laboratory facilities

Among the distilleries that distill their product by using a pot still, only 20% had on-site laboratory facilities (Fig. 3). In contrast 45% had no laboratory facilities at all, while approximately 1/3 of distilleries had access to off-site laboratory facilities. Some of the laboratory facilities were limited to the presence of hydrometers and perhaps a pH-probe and a microscope; while fully-fledged laboratory facilities were often available at the large distilleries. Often facilities at the large distilleries were the off-site facilities for the smaller malt-distilleries. Many of the large distilleries had a full complement of analytical facilities, including: HPLC, GC, NIR, and fully functional microbiology facilities.

Yeast Propagation

In the Bourbon distilleries the yeast is typically grown as a fresh culture from a proprietary stock culture, and re-used in a similar fashion to what is common in many breweries. A completely fresh culture is grown once every 8-10 generations. The Bourbon distilleries also allow for the specific presence of lactic acid bacteria, with some distilleries purposely inoculation with lactic cultures.

The vast majority (80%) of distilleries (excluding the Bourbon distilleries) did not specifically grown or slurry their yeast before pitching into the wort. This means that cream yeast or blocks of compressed yeast were directly added to the wasbacks. Distilleries using active, dried yeast did use a dehydration step to reactivate their yeast.

Apart from the lack of any specific processes to facilitate the propagation of yeasts prior to inoculation; most distilleries do not aerate their wort at the commencement of the fermentation. Among the distilleries that do aerate their wort, about half do so by vigorous stirring while the other half actively aerates by direct input of air into the wort.

Pitching Rates

The pitching rates used in the distilling industry are probably all very similar, however, every individual distillery reported their pitching rates in very unique units. These ranged from L or kg per tonne of malt (depending on the use of cream or pressed yeast), to L or kg per fixed volume of wort (dictated by size of individual washbacks), to cells per mL. Below are some typical pitching ranges used by the various respondent distilleries.

- 17 – 25 L / tonne of malt
- 0.25 – 0.4 kg / hL wort
- 1.3 – 2.2 L / hL wort
- 1×10^6 – 2×10^7 cells / mL

Pitching Yeast Quality

The vast majority of distilleries reported that they did not carry out any checks on the viability of the pitching yeast. In fact, none of the respondent malt-distilleries (those using pot stills) carried out any microbiological test. Among the larger distilleries (those using continuous distillation) about half carried out viability tests. The Bourbon distilleries ALL carried out viability tests.