Introduction

Part 1
MSU/ LTU ARTISAN DISTILLING PROGRAM

• Established to promote the establishment and expansion of artisan distillers
• Activities include: education, service, and research
• Designed as a dedicated program for all distilled spirits
MSU/ LTU Artisan Distilling Program
Contributors

• Uncle John’s Fruit House Winery (dba Red Cedar Spirits) / Working Bugs
• MSU AgBioResearch
• Carl Ing GmbH
• Brewing and Distilling Technologies Corp.
• State of Michigan
FACILITIES

• Complete distillery with 150l Christian Carl still equipped with three tray side column.
• A 450l Christian Carl still for stripping and botanicals
• An 800l, 38-tray Christian Carl vodka still
• A 10l Christian Carl still for experimental work
• A packed column is for high rectification work.
• 2, 30, & 400L fermenters for lab/development work.
• Access to brewhouse and fermenters up to 16,000L for production
• Comprehensive analytical instrumentation: GC, HPLC, Anton Paar DMA 5000 densitometer, Karl Fischer water analyzer
• Continuous stripping
• Mashing vessel
EDUCATIONAL ACTIVITIES

• Artisan Distilling Workshop™- two day, East Lansing- MI, Las Vegas- NV, Bethel-NY, Järvsö- Sweden
• Book entitled, *Artisan Distilling* on CD-ROM
• Website- [www.artisandistilling.org](http://www.artisandistilling.org)
Artisan Distilling

A Guide for Small Distilleries

Kris Arvid Berghund, Ph.D.

ELECTRONIC EDITION 1.0.0
MARCH 25, 2004
SERVICE ACTVITIES

- Analytical- trouble shooting & quality control
- Experimental distillations for process and product development
- Can perform proprietary work under contract
- Fee structure upon request
RESEARCH ACTIVITIES

- Develop quality indicators - congener monitoring and control
- Control of regulated compounds
- Yeast screening for congeners (Fermentis and Lamelland)
- Barrel aging
Some definitions

- The agency that licenses at the Federal level is Alcohol and Tobacco Tax and Trade Bureau, the Department of Treasury (TTB), *not* the Bureau of Alcohol, Tobacco and Firearms, the Department of Homeland Security (BATF).
- Code of Federal Regulations-27 CFR
TTB

- Website- www.ttb.gov
- Has course in Cincinnati
Recognized classes of spirits

- Class 1; neutral spirits or alcohol.
- Class 2; whisky.
- Class 3; gin.
- Class 4; brandy.
- Class 5; blended applejack.
- Class 6; rum.
- Class 7; tequila.
- Class 8; cordials and liqueurs.
- Class 9; flavored brandy, flavored gin, flavored rum, flavored vodka, and flavored whisky.
- Class 10; imitations.
- Class 11; geographical designations.
- Class 12; products without geographical designations but distinctive of a particular place.
Steps in production of distilled spirits

- Raw material
- Fermentation
- Distillation - flavor development
- Aging
Basics of distillation

Part 2
DISTILLATION - MOTIVATION

• Concentrate aromas, flavors, and alcohol
• Several operational parameters possible
• Remove the negative compounds, in particular, the fate of methanol
DISTILLATION

• A process involving an equilibrium between two phases - liquid and vapor.

• For a pure compound, a sharp boiling point usually exists.

• For a mixture, however, a phase equilibrium exists over a range of temperatures.
UNIQUE VLE OF ETHANOL-WATER SOLUTIONS

- For ideal mixtures, the mvc is always at a higher concentration in the vapor phase than the lvc.
- The boiling point of the mixture should be a continuously increasing value as the concentration of the lvc is increased.
- This is not the case for ethanol-water.
- The boiling point has a minimum value for a mixture.
- This is called a minimum boiling azeotrope.
TYPES OF DISTILLATION

• Simple batch - no rectification

• Alambic - some rectification

• Column - active rectification
• Rectification is the result of equilibrium contact between two phases
• The liquid and vapor leaving the contact are in equilibrium
• Rectification, also called enrichment, results in a higher concentration than would occur in a single equilibrium contact
Some vapor condenses to liquid and returns to the pot.
INDIRECT STEAM HEATING (ALAMBIC)

Some vapor condenses to liquid and returns to the pot.

Figure courtesy of Christian Carl Ing. GmbH
INDIRECT HEATING WITH RECTIFICATION

INCREASING TEMPERATURE DOWN THE COLUMN, HIGHEST TEMPERATURE IS IN THE POT

Figure courtesy of Christian Carl Ing. GmbH
RECTIFICATION COLUMNS

Figure courtesy of Christian Carl Ing. GmbH
BATCH DISTILLATION

- Use “cuts”
- “Heads”- remove acetaldehyde, methanol
- “Hearts”- product rich in aromas and flavors
- “Tails”- fusel oils, dilute
Heads 80% ABV
Hearts 70% ABV
Tails 30% ABV

10% ABV
Classic cognac distillation
Typical malt distillery flow diagram (Nicol, 1989)
A selection of different pot still shapes (Whitby, 1992)
Armagnac still. A: head of wine; B: cooler; C: wine heater; D: head condenser; E: wine arrival; F: column; G: boilers; H: head column coil; I: swan neck; J: coil; K: drawing and recycling of tailings; L: alcohol-meter holder; M: furnace.
Coffey still (Panek and Boucher, 1989)
Schematic flow diagram of bourbon beer still and doubler: a) Beer still stripping section; b) Entrainment plate; c) Rectifying section; d) Copper demister; e) Condensers; f) Doubler (Watson, 1993)
Five-column still for neutral spirit production (Wilkin et al., 1983)
Pot distilled rum
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