

## PRODUCTION OF VODKA FROM POTATOES

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### ABSTRACT

The prime objective of our project was to search out and describe the assembly of ethanol from potatoes and explore mistreatment another fed for the assembly of ethanol from cellulose. Despite distillation and multiple filtering, it's unacceptable to supply 100% ethanol. The answer with a minimum ethanol content of 96%, that is employed to supply vodkas, conjointly contains trace amounts of different compounds like, esters, aldehydes, higher alcohols, methanol, acetates, carboxylic acid and fuel. The simplest results were obtained employing a brewer's yeast within the second treatment, that showed higher substrate-to-product conversion, higher fermentation yield and a higher ethanol content. Following fermentation, the medium was processed mistreatment natural action, and 2 serial distillations and filtrations were conducted. Potatoes as being terribly cheap. Concerning that reality, it's vital to hold on analysis on the analysis of the composition and corroborative the believability of the made vodkas. This paper summarizes the studies of John Barleycorn composition and corroborative the believability and detection of falsified product. Potato mash was chosen as a renewable carbon supply for ethanol fermentation as a result of its comparatively cheap compared with different feedstock thought-about as food sources. the assembly of alcoholic beverages is predicated on the yeast-catalyzed chemical conversion of sugars into alkyl radical alcohol and CO<sub>2</sub>. The ethanol produced using this process can be consumed as products such as wine, beer, or cider or subsequently distilled to products such vodka.

**Key Words:** Vodka; fermentation; potatoes; secondary compounds; distillation

### INTRODUCTION

Potatoes are vital crops, surpassed in their overall production solely by wheat, corn and rice. The worldwide cultivation of potatoes (*Solanum tuberosum* L.) is especially noteworthy, per the Food and Agriculture Organization of the UN. (1) As per FAO estimation, in 2019, over 370 million metric loads of potatoes were created worldwide, a considerable increase from a production volume of 333.6 million tons in 2010. (2) Throughout September 2017, Uttar Pradesh is that the major Potato manufacturing State with 31.26% of production share, followed by state, Bihar, Gujarat and Madhya Pradesh with 23.29 %, 13.22%, 7.43% and 6.20% share severally. (3) Though alcohol for vodka may be hard from any macromolecule supply, cereals or potatoes are needed raw materials for vodkaproducers in Baltic countries. Producers in alternative countries additionally use sirup (from

cane and sugar beet), grapes, and rice counting on price and market necessities. Indeed, the Canadian rules

(B.02.080.) need vodka to be made of cereals or potatoes, whereas European Union rules need vodkas that are made of materials apart from cereals and potatoes to be labelled as such.

(4) Vodka could be a fairly tasteless and neutral spirit product that is principally derived from the fermentation and distillation of grain. However, some producers can use alternative raw materials like potatoes, sugar beet, grapes, or cassava rather than grain, counting on the native availability and price. Once the grain or similar has been regenerate into neutral alcohol by fermentation and distillation, the vodka producer can begin the method. Completely different producers have developed their own ways of production.

## VODKA PRODUCTION AND HISTORY

Vodka could be an enormous and varied class of liquor and in contrast to another spirits, there aren't any set rules governing its production. Spirits contain a Russian origin and is usually known as a "neutral grain spirit" as a result of the quality methodology for creating it's by chemical action and distilling grain. this will be corn, rye, wheat, or the other grain that the producer chooses to use. Potato spirits has long been a well-liked product of European nation and different potato growing regions, like Idaho and Scandinavian countries. spirits may be distilled from nearly something, although and you may notice vodkas made of things like beets and grapes.

Vodka could be a corrected spirit, which means that it's typically distilled a minimum of thrice. Some are distilled 5 or additional times. it's become common follow for a spirit complete to broadcast that their spirits have been distilled X range of times. the idea is that the additional times it's distilled, the cleaner and drum sander it's. Generally, this can be true. As spirits takes every trip through the still, the "heads" and "tails" are typically removed. These are the components of the distillation found on the highest and bottom of a finished batch. By taking solely the "heart" of the distillation, the spirits become cleaner and has fewer impurities.

After distillation, spirits could also be filtered through charcoal. spirits need no aging and is prepared to drink promptly. However, it's cut with water from still strength to bottling proof, that is usually 40% alcohol by volume.

(6) needed intoxicant is created on the premise of corrected plant product and treated water, with a strength of thirty-seven.5% vol. up to 56.0% vol., that has no color and is an aqueous-alcoholic resolution with a mushy, inherent spirits style and characteristic spirits aroma. In Russia special quite spirits are created with a strength of thirty-seven.5% vol. which matches up to forty-five.0% vol. with a such as aroma and style, obtained by instigating varied flavor elements

(10) In Western countries range of alcoholic beverages are created with barley malt as each the supply of starch and also the saccharifying agent. In distinction in Oriental countries, alcoholic beverages are created with koji because the supply of starch and saccharifying agent. In some areas in Japan, rice wines were created with human spit because the saccharifying agent and used in celebrations and non-secular festivals. Around 1850, on the islet of Amami, situated within the most

southern a part of Japan, the islanders began to create AN intoxicant, known as miki, mistreatment saute rice and raw sweet potato mash rather than human spit because the saccharifying agent<sup>2</sup>. Miki was a thick, whitish suspension that was drunk directly while not filtration.

(6) So, the secondary and commonest and obligatory methodology in production of spirits with higher potency of purity is water. Water for the assembly of spirits ought to be soft, moderately mineralized, clear, colorless and should don't have any odor. The optimum values of spirits and special spirits cationic and anionic composition permitting to retrieve specific organoleptic characteristics and attaining stability throughout future storage.

Many corporations claim to use mountain spring water from the mountain springs or some crystal clean supply of water for the assembly of spirits that is thought for its smoothness. This methodology can't be discounted and is incredibly obligatory for the distillation and bottling method.

(8) The plant product needed ought to be distilled to ninety fifth plant product, then dilution should ensue to 70-80 proof for distribution method. If the manufacture isn't distilled to the given higher proof, then it's not technically thought of a spirit. totally {different completely different} beginning materials can lead to a rather different flavor, that several craft producer target particularly. The distinctive beginning material is what provides every direction its definite flavors. Recent customers incorporate some eightieth girls WHO are within the cohort that higher than the age of thirty-five years. Their tastes coincide with fruity saporous, fruity aromatic drinks. a way to supply this with the industrial plant is by beginning the assembly of a line of saporous vodkas to make fast interests among them. so as for the purchasers to style the spirits spirits created.

(7) to begin off the method, the material is ground into a fine powder and mixed with water and varied enzymes and microorganism to organize for fermentation. it's allowed to ferment then fed to the distillation method to get rid of the plant product to extend the proof of the spirit to a hundred ninety. Then clean water is other for the ultimate product. plant product fermentation is evaluated at 2 totally different pH profiles to see the impact of pH: uncontrolled pH and controlled pH at five.5. The results clearly indicate that the next rate of growth for biomass was obtained with the controlled pH at five.5

## **PROCEDURE FOR MANUFACTURING OF VODKA**

### **➤ POTATO MASH PROCEDURE:**

- ❖ Scrub potatoes with a produce brush to remove residual dirt.
- ❖ Cut potatoes up into cubes to increase surface area.
- ❖ Boil Potatoes for 20 minutes in 7 gallons of water.
- ❖ Mash potatoes by hand or by using an immersion blender.
- ❖ Transfer the mash to your mash pot and add water to reach 7 gallons of total volume.
- ❖ Raise the heat of your mash to 140 °F. Stir mixture continuously until desired temperature is reached.
- ❖ Add 5 pounds of crushed malted barley, continue to stir while adding barley.
- ❖ Hold mash at 140 °F for 20 minutes. Stir for 30 seconds every 4 minutes during this point.
- ❖ Raise temperature to 152 °F and hold for 1 hour. Stir for 30 seconds every 10 minutes.

- ❖ Cool mash to 75 °F. If time allows, cool overnight to offer barley enzymes longer to interrupt down potato starches.

➤ **FERMENTATION**

- ❖ Create a yeast starter by following these steps:
  - ❖ Sanitize a standard mason jar.
  - ❖ Pour 4 oz. of 110 °F water into the sanitized jar.
  - ❖ Add 2 tsp. of sugar to the water, stir thoroughly.
  - ❖ Mix in yeast (Amount depends on type of yeast used, follow directions provided).
  - ❖ Stir thoroughly.
  - ❖ Let the starter sit for 20 minutes. You should see the mixture's volume double during this time.
- ❖ Transfer the mash liquid only to the fermentation bucket. You can pour the mash through a strainer to realize this. Try to create the maximum amount splash as you'll without losing liquid to properly aerate the mixture.
- ❖ Add the yeast starter to your fermentation bucket.
- ❖ Add airlock and ferment mixture for 2 weeks at room temperature.
- ❖ Once fermentation has completed, we'll need to completely remove any solid material. The solid material left over can cause headaches if left within the wash. A cheesecloth may be a great option for straining the wash before distillation.

➤ **DISTILLATION**

❖ **Materials**

- Still
- Fermented and Strained Mash Water
- Cleaning Products
- Column Packing

Well done, at now you've actually done all of the work necessary to supply your vodka. It just happens to be swirling around with a bunch of other stuff that you simply don't want.

Now involves process of separating your vodka from all of that other stuff. Or, as the process is more commonly known, it's time to distil your vodka.

❖ **Prepping Your Still**

This is a step that goes avoided only too often. If you would like to maximize the standard of your product, it's all about attention to detail. So, we'll want to start out our prep-work by cleaning the still.

Even if you've cleaned the still after your last run and let it sit for a short time, we'll want to wash it again. If you're just now learning how to make vodka, or any other spirit, now is the time to really emphasize this so you can build good habits.

Next, we'll want to feature clean copper packing to your column. Vodka may be a high-proof spirit, so we'll want to maximize reflux during the run. If you've got a condenser, now's the time to hookup the water input and output.

Finally, it's time to feature your wash to the still! We recommend using an auto-siphon for this process. The name of the game here is to reduce the amount of sediment in your wash as much as possible.

❖ **Running Your Still**

The time has now arrived to fire up that still. Ensure your column is full of copper packing, any domes, columns, or condensers are properly attached, also as any hoses. Next, we'll activate the warmth source and begin raising the temperature of your wash. If you're employing a copper still, apply flour past to the joint between the vapor cone and column once you reach 110 °F. If employing a condenser, activate the water when the boiler reaches 130 °F.

At about 170 °F the still will start producing. You'll want to dial in your heat source setting to realize a uniform 1-3 drips per second.

➤ **COLLECTING YOUR POTATO VODKA DISTILLATE**

Collecting your vodka is perhaps the foremost satisfying a part of this complete process. This step is part art, part science. It takes a sensitive and experienced distiller to urge this process good.

If you miss the mark slightly on a couple of of those steps, don't get discouraged. You'll still have an honest quality product and you'll only recover with practice.

➤ **ADDING WATER AND FLAVOUR ADDITIVES**

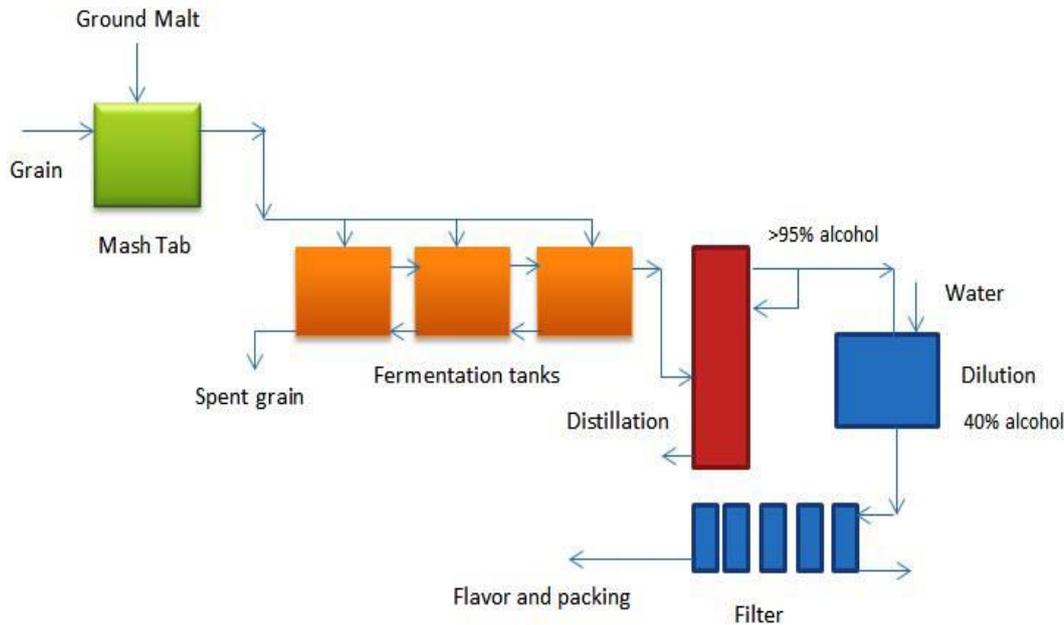
After distillation, produced liquid have between 95-100% alcohol content. To became drinkable, water must be added to weaken the alcohol to the standardized 40% level (some countries have varying laws about the required alcohol content). If distiller wants, at now he can add flavor additives.

➤ **BOTTLING**

Vodka doesn't have aging processes like wine or whiskey. It can immediately be transferred into non-reactive glass bottles. Automated distilleries use machines to sometimes process 400 bottles per minute

## FLOW DIAGRAM

This is a block representation of the production of vodka in industries and also for the method which we have applied here. The process somewhat takes place in the same steps as shown below:



## ETHANOL ANALYSIS

(11) Most of the vodkas were very well distinguished in the plotted graph, while some were too close to each other which had made the identification difficult. Nevertheless, this study demonstrated that the electronic tongue is often successfully used for identify vodka brands. The application of conductivity measurements to differentiate vodka brands. Each sort of vodka displays a selected conductivity thanks to the raw materials and methods utilized in the assembly process. The use of flavorings doesn't have a big effect on the conductivity; therefore, the tactic is often wont to distinguish among the vodka brands.

(9) In general, gas chromatography is used to analyze the vodka composition. The largest number of compounds comprising the matrix was detected by employing two-dimensional gas chromatography because this system is characterized by high sensitivity and high peak capacity. Gas chromatography is an analytical technique for volatile and semi-volatile compounds. Many ethanol analyses have through with GC since impurities in ethanol are basically volatile also as ethanol itself. A sample is vaporized at an injection port by heat. The sample vapor is shipped to column full of adsorbent or absorbent. Inside column, each component in sample is separated counting on its physical and property. The end of column the concentration of each compounds is measured by a detector. A coating should be chosen counting on the target compounds. Also, there are many kinds of detectors. Each detector has advantages and disadvantages. Thus, a detector should even be chosen carefully to detect target compounds. Gas chromatography-mass spectrometry (GC-MS) is an integrated system of two analytical equipment. Gas chromatography separates analytes and mass spectrometry identifies them. GC-MS accelerates ethanol analysis with its simultaneous separation and identification captivities

Studies conducted my means of HPLC were the rarest thanks to the very fact that the volatile substances present in vodkas are best analyzed via GC. Until now, the chemicals belonging to alcohols, aldehydes, ketones, esters, terpenes, aromatic compounds and volatile Sulphur compounds are detected in vodkas. The product authentication and detection of falsified products are of utmost importance in reference to the standard of alcohol consumed.

(6) In the alcohol quality control system with physicochemical method of analysis, one of the top positions is organoleptic analysis (OA), which constitutes determining the look (transparency, presence of foreign matter), color, smell, aroma (bouquet) and taste by the human senses. With of determining the organoleptic characteristics of the products using OA and creating their identity with the requirements specific by the recipes, technological indications and regulatory documents for this product. Organoleptic evaluations are carried out by specialist tasters with specially knowledge and experience in testing the organoleptic characteristics of produces. The characteristic of organoleptic indicators is translated in a quantitative assessment, which is given in point wise. While using a 10-point scale, it gives a characteristic of product quality regarding to the following main indicator such as its transparency, color, aroma or smell, taste, the segregation of maximum points according to individual organoleptic indicators is given as following: appearance (transparency and color) - 2 points; aroma with smell - 4 points; taste - 4 points. Impurities, even in small amounts, will affect the tasting characteristics of the alcoholic beverage. Most of the aldehydes gives ethanol astringency, viscosity and pungency in the means

of taste; the presence of carboxylic acids, unsaturated, nitrogenous, sulfur compounds are followed by a deterioration in the smell, the look of astringency bitterness along “aftertaste”. Irritating suffocating and sharp fusel tones is carried by samples containing butyl, isobutyl and isoamyl alcohols; samples with a higher concentrations of propyl alcohol have a weak oily floral tone along with a hint of sulfuric ether. Esters add a usual fruity floral scent to ethanol.

### VODKA AND OTHER BEVERAGES

(11) In comparison to other spirit-based beverages, vodka has the poorest aroma profile; therefore, it is easy to distinguish it from other alcohols. Such studies were conducted thanks to the use of electronic nose, infrared spectroscopy and sensory evaluation. The task of identifying different vodka types seems more difficult. Until now, vodkas have been identified based on the quality of ethanol used in their production, which was assessed via electronic tongue or gas chromatography

(5) A representative list of liqueurs and some other beverages is given below

PRODUCTS	NOTES	COUNTRY OF ORIGIN
Absinthe	Brandy flavored with sweet almonds and apricots	France
Advocaat	Brandy-base, Egg yolks, sugar and vanilla	Holland

Akvavit	Anise, caraway seeds, coriander dill, fennel and grains of paradise	Scandinavia
Amaretto	Apricot kernel and bitter almond flavor	Italy
Anis	Anise/Star Anise/fennel flavor	Diverse
Arrack	Distillation of alcohol from grapes, sugarcane, rice or dates. Word means 'sweat'	Arabic
Bailley's	Irish whiskey and chocolate	Ireland
Benedictine	Brandy flavored with 27 plants (including cardamom, cinnamon, cloves, juniper, nutmeg, tea and myrrh) and sugar. Colored using saffron and caramel	France
Bitters	Diverse, including Angelica root, artichoke leaf, cascarilla, Cassia, Gentian, bitter orange peel, quinine, thistle leaves, wormwood leaves, and yarrow flowers	France
Chartreuse	Blend of 130 herbs and honey in brandy	France
Cherry brandy	Distilled juice of cherries, fermented in presence of crushed cherry stones, perhaps blended with Armagnac	Mainland Europe
Cointreau	Blend of distillates from bitter and sweet orange peel, plus sugar	France
Drambuie	Scotch whisky suffused with herbs, spices and heather honey	Scotland
Grande Marnier	Cognac blended with distillates of bitter orange and sugar	France
Malibu	Light rum/ coconut	Barbados
Ouzo	Aniseed and fennel and mastic distilled in copper stills and lt;1000 l	Greece
Pastis	Aniseed and liquor rice	France
Raki	Aniseed	Turkey
Pernod	Spirit base suffused with star anise, fennel, chamomile, coriander, veronica	France

	and other herbs	
Sambuca	Anis, star anise, Elderflower, invert sugar	Italy
Southern Comfort	Grain-based spirit containing peach and orange and sugar	US
Tia Maria	Cane spirit/rum base with coffer and spices and sugar	Jamaica

This review paper shows that despite many years of research and using numerous techniques, vodka still remains an interesting object of investigations

### ENVIRONMENTAL HEALTH AND SAFETY

(8)The establishment of an equipment such as a still it is necessary to take into consideration some various environment and safety concerns associated with the project. One necessary part is that the issue of risk related to the upper temperature vapors that are related to distillation. It's doable that with a vapor cloud of ethyl alcohol within the still, there would possibly occur an explosion with metal shards being flung far from the plant or building. The building at this site is open, and can typically have customers walking through and for of the building. So, it's explicit that the location being employed for the still be encircled by the assistance of plexiglass wall that saves customers from any accidents. The hammer mill will turn out each clap pollution and mud particles. it's educated that the operator ought to wear ear protection and so operate the mill whereas the building is safe and far from to the general public to stop the grain particles from sitting on the opposite components of the building. One necessary environmental thought is what ways be introduced for the waste from the method. The upper proof heads and tails of main distillation will be place down the drain, but the leftover mash could be an immense amount and is far additional viscous, and should not be removed in this technique. There are two environmentally friendly and economic ways for such waste, initial manner is to collect the mash into the tanks and produce it to a farm for animals to consume. There's an embarrassment of edible grain gift within the mash that animals can like, though there's a tiny low quantity of alcohol left over that won't be harmful for the animals. Another choice is to use the grains as fertilizers. There are a unit masses nutrient within the mash and it'll be wont to aid in growth of additional grains to feed to the method.

## CONCLUSION

With any style of work, there are continuously obstacles that cause valuable learning experiences within the room and in trade. Within the style info, the main focus is on technical details and making a method that leads to the required specifications while not regard for potency or price. Through this project, the experience led to a more realistic process problem, operating with a decent budget, the method was on a restricted scale, as well as all essential components of the method. In several scientific processes, there's a rigid and established technique for making a product. Conversely, creating craft spirits like vodka or whiskey, features a heap of space for creativity. There have never been two batches that unit precisely the same, and no 2 recipes that manufacture an equivalent product.

There is a unit sure necessity for numerous liquors to be tagged below a definite name, however the method to get those specifications may well be something among reasons. Concerning that truth, it's vital to hold on the analysis on composition of vodkas. This project summarizes the study of ethanol composition and confirmative the credibility and detection of falsified merchandise.

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