



# Ritchy Safety Uniqueness

From the very beginning, Ritchy is focused on the safest possible e-liquid development in the market. Learn more about our unique R&D and Manufacturing.

## 1. In-house analytical and flavor development lab



E-liquid is a product that is atomized and inhaled by the consumer. Without in-depth knowledge of components and their lifecycle in the product - it's impossible to control the safety of the product. The in-house mass-spectrometry equipped lab is the only solution that allows effectively study of subjects of interest.

Even more important is knowledge and methodologies that were developed by Ritchy over many years.

Calibration for hundreds of components, unique methods of nicotine analysis, tobacco-specific nitrosamines and dozens of unique analytical methods. For any fully-equipped professional lab, it will take years to develop similar efficiency and precision.

**Ritchy possesses unique knowledge developed over many years to be able to effectively and precisely control e-liquid product safety.**



## 2. Toxicity profiling

After flavor formulation made by Ritchy flavorists, products are tested by analytical chemists. Every component that is known to be present and all components that are parts of extracts or compounds are verified for inhalation toxicity from multiple international databases. Based on the most aggressive type of consumption every component is controlled to be strictly within limits of long-term safe exposure.



This takes a tremendous amount of work, but Ritchy was always inclined to be as safe as possible from everything that is currently known to science. Being just better than combustible cigarettes is NOT enough. Almost all of the internally tested competitors' products on the market did not pass strict Ritchy toxicity standards.

**While international tests revealing unsafe levels of components in competitors' products, Ritchy ensures that everything that is known about inhalation toxicity is in use to make products within internationally agreed levels of exposure.**

## 3. Emission testing

Ritchy is one of the first companies that started to test emission results of e-liquid. With many flavor components inside it's important to know that they can successfully survive the atomization process without decomposing to more hazardous chemicals. In addition to that, Ritchy tests the distribution of particle sizes with different chemicals. Ritchy's In-house technology for emission collection is more precise than the proposed technical standards in the EU.

**Ritchy has an ability to ensure that liquid toxicity does not increase during vaping with proper emission testing.**

## 4. Shelf-life validation

Ritchy products have a 2 year shelf-life. Every product goes through a 1-month accelerated test where e-liquid is kept in 3 different conditions and the approximation model is built to estimate a 2 year period for each product. After the test is adjusted and the complete product is analyzed for formulation change and toxicity profile compared to the original. If the toxicity of product increases over time - the formulation is discarded or reworked. After formulation with stable toxicity finished 2 years old e-liquid compared by the panel team with new product and it's required that 9/10 of the panelists should not be able to distinguish the difference on a triangle test.

**Ritchy quality requirements ensure that our e-liquid does not become more toxic during the projected transportation, storage and shelf display and our flavor taste is preserved**

## 5. Demixing elimination



While the base liquid is a good solvent for flavor material, it's possible that some natural extract components might eventually get demixed and give a high concentration of specific chemicals being used in the device. That potentially can expose a consumer to high levels of components and increase acute toxicity beyond defined limits.

Ritchy uses high-speed centrifugation with mass-spectrometry testing to speed up the demixing process 100`000 times and verify that even after 2 years demixing is not occurring beyond 1% of formulation variation. **Attention to product safety details at all aspects of usage is key.**

## 6. Devices compatibility

Before the release of any e-liquid product on the market, Ritchy test all of our formulations that contact various internal components of e-cigarettes and devices on the market. Weight of parts compared after long-term exposure on ultra-precise laboratory balances and residual liquid analyzed for components potentially change with original formulation to verify if liquid reacted with any components of e-cigarettes. **This is critically important to ensure that contact of liquid with a device does not increase product toxicity.**

## 7. Components rigorous testing

With more than a thousand components used for liquid development, Ritchy uses the in-house lab to test 100% of incoming batches for safety and standards. Most components passing through the volatile components gas mass-spectrometry - expensive testing that is done in the pharmaceutical industry. Batches also going through heavy metal testing on plasma mass-spectrometry and non-volatiles are passing through external liquid mass-spectrometry. Very few manufacturers to our knowledge are capable of doing incoming materials screening due to the cost of outsourced analysis. **Ritchy has a high level of confidence in materials used in the preparation of liquid.**

## 8. Analysis of original chemical components

Some hazardous components in the final product can be almost undetectable by any current equipment, but it still can be enough to do potential harm to people or influence the taste. Ritchy produces a significant part of the portfolio from basic non-compounded chemicals, while most of the market players deal with mixes made by other flavor houses. **That allows Ritchy to analyze components in a highly concentrated form and verify that they are of proper quality.**

## 9. Zero Cross-Contamination Protocol

Combination of procedures that Ritchy implements allow complete isolation of surface contamination between different liquids. And with more than 300 SKU of products, it requires special approach that Ritchy has mastered over the years.

**Strict following to internal protocols allows Ritchy to manufacture pure flavors and uncontaminated products for many years.**

## 10. Automatic Gravimetric Dosing



There are 2 main ways of how components are measured during the dosing process. Volumetric - means by volume and gravimetric - means by weight. The volumetric approach assumes using a container with volume markings where the operator visually checks the amount of component added into container and later disposed of in the mixing tank.

Problem with old approach used by other companies in the industry that operators often make mistakes and on top of that some amount of material stays in the original container. Plus measurement containers often reused and there is almost no possibility to ensure they completely cleaned between usages with different materials.

Ritchy developed own unique compounding system that uses a 0.01% precision "state-of-the-art" gravimetric system that automatically drives peristaltic pumps to deliver components in the mix by weight. Components in use automatically checked by RFID scanner from the original drums of components. This way the possibility of operator mistake is almost completely eliminated and precision of mix is better than 0.1%. While there are more companies switching to this approach, it's still relatively unique in the vaping industry and more close to pharmaceutical standards.



**This allows us to have known on the market unique consistency of the product without potential mistakes in hazardous materials dosing.**

## 11. Multi-axis high-speed mixing process



The majority of manufacturers are using old-style stirrers which require moving material from mixing tank to dispensing tank and losing the precision of material dispensing. They also have contamination possible since stirrer is touching different materials during the day and have to be thoroughly washed. On top of this liquid has access to the open air and can absorb any contamination for a long amount of time.

Ritchy is using multi-axis mixers with nitrogen inside. That avoids contact with different liquids, prevents contamination from air or from different mixtures and ensures a much higher precision of mix without potential that some individual bottles would get a significantly higher concentration of nicotine or flavor component which can make a product more toxic or rapidly change the taste. On top of that, it prevents premature oxidation of e-liquid during the mixing process.



**All together it gives the best on the market product consistency.**

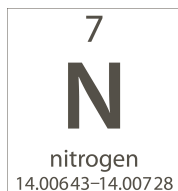
## 12. 100% in-process Quality Control



Despite the high precision of dosing and component verification, there is always a chance of something going wrong in production. Ritchy verifies every batch of e-liquid with a high precision density and refractive index meters and validates that the components mix is according to the standard.

In-process Quality Control is still rare in the vaping market. **100% batch control is a pharma-level requirement that Ritchy voluntarily implements for years.**

## 13. Nitrogen Headspace replacement



E-liquid is a product that easily oxidized being exposed to oxygen. Ultra-High Purity Nitrogen is used to remove air from a production container before mixing. That allows tremendously elongate shelf-life of the product and have a much more consistent mix without danger of premature product expiration. On top of that large format products individual bottles also go through air removal procedures to prolong their shelf life even further.

**Predictably long shelf-life of the products ensures that in all conditions products stay the same quality as new.**

## 14. Vacuum sealing verification

All bottled products by Ritchy are passing 100% vacuum testing twice surpassing requirements for transportation test for leakage (-65kPa, 3 times for 30 minutes). That not only allows us to make sure trade is not going to get damaged goods but validates that containers are highly air-tight packed. **This way contamination of liquid is highly improbable.** The majority of off-the-shelf bottles available for e-liquid are unacceptable for our standards while being widely used in the market by most of the competitors.



## 15. Full batch sample retention storage

Ritchy produces dozens of thousands of batches of products. And after all precautionary steps, QA and QC, the company stores every single batch sample in normal warehouse conditions. With any request from the trade about product quality there is always availability of sample of exact same product batch that has stayed for the same amount of time on the shelf. This way Ritchy can quickly and thoroughly analyze the product for any inconsistency that could have happened on the shelves or in production that might have slipped through all testing procedures.

With the complete raw material tracing database Ritchy can quickly react and identify batches of products that could have been affected. While throughout history nothing dangerous was found in products - **the ability to quickly react and ensure that product is within specification is a unique advantage of Ritchy.**

## 16. TPD and internal standards

Ritchy was effectively ready when Tobacco Product Directive 2 in the EU came into effect. But the company took it very seriously to prepare everything required to provide as comprehensive and full data as possible. Thousands of toxicity research papers were collected and studied. Many man-years were spent on verification and preparation of data according to standards.

**Ritchy provides the most verified and controlled liquids available nowadays.**

## 17. Security code and batch materials tracking



From 2014 Ritchy uses a security and batch tracking system developed in-house. Every single product produced from that time (and at this moment - all products in service) is stored in the database with 2D codes available for consumers. That can be used to validate that the product is genuine (# of checks is limited, so any counterfeit products run out of codes) and to have a connection directly to the consumer.

Internally, Ritchy can check by the code which batch of Raw Materials was used for that product. In the production process, all batches of materials are verified by RFID from Ritchy Material Tracking Database.

Ritchy tracks dozens of millions of units with more ¼ million people validated their products.

The pharmaceutical industry is only now switching to this approach and Ritchy uses it without regulators requirements for many years. Due to the complexity and cost of this system from outsourced vendors, we do not see any other e-liquid brand using such system on the market.

**At the time when a lot of products are counterfeit and potentially dangerous, Ritchy is the only supplier that gives peace of mind to a consumer.**

## 18. Proven track record

Brand Liqua is one of the oldest e-liquid brands on the market. Moreover, the most popular flavors are unchanged in the last 7 years.

**With millions of bottles sold per each flavor for many years, we got zero complaints from consumers about any health issues.**

Ritchy gets emails of gratitude from people who consistently use the same flavors from Liqua portfolio for more than 5 years on a daily basis.

It's a rare case on the young market of vaping. Ritchy probably constitutes the largest single company share of consumer flavors with 7 or more years of market presence in unchanged form.



## 19. Certification

Ritchy complies to all necessary certification for Child-proof protection ISO 8317, ISO 9001:2013, Good Manufacturing Practices, TPD 2, FDA, GHS & CLP, RoHS, WEEE, CE. Bottles have tamper-proof protection to ensure that **product comes in original form as intended and tested by Ritchy**. More than 6000 SKU of products are verified and continuously updated by the Ritchy Compliance Team.