

The excessive use of sulphur and creation of *stomme* as an early modern cellar technique in Dutch wine trade

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Abstract

On the basis of study of early modern literature and other period sources we describe the production and use of *stomme*, used by Dutch wine merchants in the 17th, 18th and 19th century. We conclude that *stomme* was made by using excessive amounts of sulphur dioxide, thereby creating health hazards. The States General of the Dutch Republic acknowledged that danger, and banned the use of *stomme* in 1613. However, the ban was never implemented and *stomme* remained in use for a long time. We argue that the ban was inspired by the risks posed to the health of the wine drinkers, but that economic reasons for a continuance of use prevailed.

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Abstract

In 1613, the Dutch Republic banned the import of *stomme*. This product, made by using excessive amounts of sulphur dioxide, was essential in the production of French white wine destined for the Dutch market in the seventeenth and eighteenth century, according to the wine merchants. This paper explores the Dutch use of sulphur dioxide in early modern wine production methods and consequently the creation of a wine product called *stomme*. Furthermore, it explains its usage, the reasons for the ban in 1613 and the consequences for public health. Since very few studies have been made into the exact techniques early modern Dutch wine merchants used to treat imported wines, this paper aims to further that insight, and help promote further study in the relationship between wine production, views on treatments and interference by the government of the Dutch Republic.

Keywords

Wine history, mute wine, *stomme*, vin muet, food quality, sulphite intolerance, public health, sulphur dioxide, Dutch wine trade.

Introduction

From the time wine was stored in wooden barrels, it became more susceptible to spoilage due to oxidation and bacterial contamination. This caused serious problems, especially for export to wine-consuming countries in Northwest Europe. The sometimes mediocre quality of the wines led to a variety of early modern treatments which were believed to offer solutions for various forms of wine spoilage. Some of those treatments were used by consumers, others by wine merchants themselves.¹ Nowadays, some of those treatments are seen as adulteration, although hardly any serious research has been done on the distinction between treatments seen as necessary and treatments as adulteration. Before the mid-nineteenth century national, regional or city governments sporadically intervened and only when certain kinds of wine treatments were seen as 'harmful'. When public health and therefore economic interests could be harmed severely by treatments of wine, governments drew a line. That happened with the addition of lead white, lead sugar or lead acetate to wine and with the excessive use of sulphur. In France and Germany in the sixteenth century, lead acetate was already added to sweeten sour white wine and to make wine longer lasting. The consequences for consumers were disastrous. In the worst case, it led to death.² The use of lead in wine was banned in Württemberg in 1696 and everywhere in Europe in the eighteenth century. The use of added sulphur or better sulphur dioxide (SO₂) during wine production was already a practice that dates to antiquity. However, uncontrolled excessive use of sulphur dioxide not only led to a sensory perceptible strong-smelling and pungent odour, but also to damaged health. The use of sulphur dioxide in barrel preparation in Germany was already limited by imperial decree at the end of the fifteenth century.³ It is a ban on the importation and use of heavily sulphurated must, then called *stomme*, issued by the States General of the Republic of the United Netherlands in 1613 that is the focus of our study.

The starting point for research into adulterating food and food safety was the chemical revolution of the early nineteenth century. Advances in chemical scientific research made it possible to detect counterfeits. In the mid-nineteenth century, the first urban laboratories were created to deal with food adulteration. Serious historical research into wine counterfeiting only started in the last decades of the twentieth century.⁴ The impetus came from France, where historian Alessandro Stanziani has been researching wine adulteration and wine regulation starting from the late eighteenth century. He concluded that preventing wine counterfeiting in France from around 1800 was mainly based on economic motives of the wine trade. In other European countries, the fight against food and wine adulteration was much less influenced by economic motives. It was in those countries rather a democratic activity based on citizens' initiatives.⁵

Indeed, in the Netherlands, from the mid-nineteenth century onwards, various books were published for the interested consumer explaining how to detect counterfeit wine. Only occasionally, however, this literature referred to the past.⁶ In the wake of the French legislative developments around 1900, albeit with great delay, the Netherlands followed with the introduction of the Wine

¹ Rob Blijleven, "Wijn in Nederland. Een verlokend panacee voor economie & gezondheid. Cultuurgeschiedenis van wijn tussen 1670 en 1970" ((PhD) Vrije Universiteit Brussel, 2020), 249.

² Blijleven, "Wijn in Nederland. Een verlokend panacee (PhD)," 97-121; Rob Blijleven, *Wijn in Nederland, een wondermiddel voor economie & gezondheid* (Zutphen: Walburg Pers, 2022), 193.

³ Blijleven, *Wijn in Nederland, een wondermiddel voor economie & gezondheid*, 188-90.

⁴ Alessandro Stanziani, *Histoire de la qualité alimentaire (XIXe-XXe siècle)* (Editions du Seuil, 2005); Alessandro Stanziani, "Products, norms and historical dynamics, Quality: A Debate, edited by C. Musselin and C. Paradeise," *Sociologie du travail* 47: S114-123 (2005); Alessandro Stanziani, "Information, quality and legal rules: Wine adulteration in nineteenth century France," *Business History* 51, no. 2 (2009); Jean-François Gautier, *Que sais-je? Le vin et ses fraudes* (Paris: Presses Universitaires de France, 1995).

⁵ Blijleven, "Wijn in Nederland. Een verlokend panacee (PhD)," 198.

⁶ Blijleven, *Wijn in Nederland, een wondermiddel voor economie & gezondheid*, 192, 220.

Decree [Wijnbesluit] of 1929. For the first time, serious work was done on quality protection for wine.⁷ This belated attention of the Dutch government to food and wine quality, apart from its permanent fiscal concerns, made the early seventeenth-century decision of the Dutch national government (the States General) to ban the use of *stomme*, a product arrived at with the use of heavy doses of sulphur dioxide, all the more remarkable. Especially so, because it went against the direct commercial interests of the Republic.

Commercial interest clearly benefited from extending the storage life of wine by applying different treatments. In the seventeenth century, Dutch wine merchants had a profound influence on wine making processes in France. Among others, they ordered the application of certain techniques to make the wines more suitable for transport. Those same techniques could also help adapt the wines to the taste of the consumer.⁸ In modern studies, those techniques have been reported on mainly in general terms. For example, contemporary French-language authors spoke of *travailler, muetter or frelater* by the Dutch merchants. But what exactly these terms meant, and what exactly the merchants did with the wines to prepare them for the long sea transport, has not really been studied. Most studies just mentioned the techniques of 'adding alcohol' and 'sulphuring the vessels'. For example, in his standard work *Historie de la Vigne et du Vin en France*, Roger Dion was rather vague about what those techniques entailed and went so far as to say that the French could not uncover the secrets of them for centuries.⁹

In this paper, we will focus on the use of sulphur and the terms *muetter* and *vin muet*. In contemporary French wine terminology, *muetter* is the stopping of fermentation by means of adding alcohol to fermenting wine, in order to obtain a sweet wine. This interpretation is used by Raphaël Schirmer, among others, in his study of the history and geography of the Muscadet, and in two studies of the seventeenth and eighteenth-century wine trade between France and the Republic.¹⁰ We will argue however that *muetter* can also mean stopping fermentation by use of sulphur dioxide and that the early modern French *vin muet* is the same as the Dutch *stomme*.

Modern studies also struggle with the Dutch terms for the various techniques used by the Dutch. This concerns terms such as *het werken van wijn* (working the wine), *gevuyrde wijnen* (fired wines) or *stomme* (literally 'something silent') and the accompanying verb *stommen* (to silence).¹¹ Nowhere are these terms thoroughly examined, and certainly no attempt has been made to harmonize between different languages. As a result, the contemporary sources remain difficult to interpret and the insight into the Dutch influence on the wine trade remains limited. Sources may even be misinterpreted. This danger especially applies to notarial deeds that report all kinds of disputes between merchants and skippers who delivered the wines to the Netherlands. Incidentally, it cannot be ruled out that the sources themselves did not always use the correct and consistent terminology, since they involved highly specialized techniques.

This article is an attempt to contribute to further research into the relationship between early modern winemaking techniques and wine treatments, wine regulation and food security. We will specifically highlight the excessive use of sulphur dioxide in the production of *stomme*, the use of

⁷ Blijleven, *Wijn in Nederland, een wondermiddel voor economie & gezondheid*, 226.

⁸ Rodney Philips, *A Short History of Wine* (New York: Ecco Press, 2000), 128.

⁹ Roger Dion, *Histoire de la Vigne et du Vin en France: des origines au XIX siècle* (Paris, 1956 (repr. 2011)), 426.

¹⁰ Raphael Schirmer, *Le Muscadet: histoire et géographie de vignoble nantais* (Bordeaux: Presses Universitaires de Bordeaux, 2010); Henriette de Bruyn Kops, *A Spirited Exchange: the Wine and Brandy Trade between France and the Dutch Republic in its Atlantic Framework, 1600-1650*, The Northern world, (Leiden: Boston: Brill, 2007, 2007); Anne Wegener Sleswijk, "Franse wijn in de Republiek in de 18e eeuw : economisch handelen, institutionele dynamiek en de herstructurering van de markt" (UVA, 2006).

¹¹ *Stomme* does not appear in well-known studies of wine history by Marcel Lachiver, Rod Philips, Roger Dion or Hugh Johnson.

which was part of the wine treatments used by early modern Dutch wine traders. We will analyse the product *stomme* and the ban issued by the Dutch States General in 1613. In our view, the ban formed the first national regulation of wine quality in the Dutch Republic from a perspective of public health.

***Stomme*: a new product on the early modern wine market**

The first mention in Dutch historical sources of the word *stomme* dates from 1612, followed ten months later in 1613 by a statute forbidding the import of a certain kind of wine, then called *stomme(n)*. The main part of the text in translation of this statute reads as follows:

AGAINST THE IMPORT OF STOMMEN

Statute, by [...] the Staten Generaal of the United Netherlands [...] forbid to import in these Lands wines that are called “stomme” and wines that are mixed with these “stomme” [...] 9th of August 1613.

The Staten Generaal declare: it is brought to our knowledge that in these countries certain wines are brought which are called “stommen” that have not been properly cleaned and purified but which to the contrary are forced by violent means to preserve their impurities: with these “stommen” other wines were mixed and falsified in order to obtain another than its natural flavour. All this will lead to obvious disruption and damage of human health and downfall of trade by improper means. To preserve health of our good residents and to prevent all frauds and evil practices, and [other] above-mentioned information and having understood what here-by has been decreed in other countries and quarters, we provide that no one should import above-mentioned “stommen” in these countries or wines mixed with “stommen” or should sell imported “stommen” or wines mixed with “stommen”[...]¹²

Earlier, on September 17 and October 22, 1612 respectively, the Rotterdam Municipal Council or *Vroedschap* had declared that they would wait for a report on *stomme* before they decided what to do. The entries in the municipal minutes do not specifically mention why a decision about *stomme* had to be made, but very probable it had to do with the same events that caused the general ban in 1613. In the ban, *stomme* is described as a wine that was used to mix with *other* wines, to influence the taste of those other wines. And it was a product harmful to the health of its drinkers. Apparently, the production of *stomme* and trade therein was substantial, since the authorities felt obliged to implement a ban on this trade. Fifteen years later, in 1628, the ban by the authorities of the Dutch Republic was followed by an almost identical one, this time in the name of the Habsburg government residing in Brussels. The text refers to older royal decrees banning the import or sale of forged wines:

¹² Translation from the Dutch original text by the authors. See: C. Cau et al., *Groot placet-boeck, vervattende de placaten, ordonnantien ende edicten van de ... Staten Generael der Vereenighde Nederlanden, ende van de ... Staten van Hollandt en West-Vrieslandt, mitsgaders vande ... Staten van Zeelandt* (By de weduwe, ende erfgenamen van wylen Hillebrandt Jacobsz van Wouw, 1658), 1214-15.

*[...] it seemed that not so long ago, quantities of certain wines, called stommen, were sold to mix with others; as a result, many people died or got sick; such wines are regarded as evil and harmful to health.*¹³

Stomme was apparently not only intended for use in the Dutch Republic. As a matter of fact, at that time *stomme* was also used in England and Scotland and still in use there at the end of the eighteenth century.¹⁴ And although officially prohibited in the Holy Roman Empire, some merchants there still had 'the privilege' to trade in *stomme* for export reasons, as was indicated in a report by former Cologne wine merchant Antony Becker to the *Staten Generaal* in 1613.¹⁵ We will come back to this report shortly.

According to notarial deeds issued in Rotterdam, one of the important wine ports in the seventeenth century, *stomme* was a regularly traded product.¹⁶ The earliest Rotterdam deed mentioning *stomme* dates from 9 July 1632: the entire crew of a ship declared that they loaded 10 pipes (4,200 litres) of *stomme*, of which a third had leaked out on the journey. And on 7 September 1633, a wine broker named Maerten Huysman, declared that he was aware of the price of *stomme* wines from Anjou, which were sold in June, July and August 1632. From these examples, it is clear that *stomme* arrived on the Dutch market in the early years of the seventeenth century. From another notarial deed, we also learn that Dutchmen were involved in producing *stomme* in France: in 1631 a certain Van Cattenburch was responsible for 'the wines stummed in the county of Nantes'.¹⁷ The fact that the Rotterdam notarial deeds from the 1630s frequently mentioned *stomme* as a product that was traded in, points to the conclusion that in the long run, the ban was not effective. In fact, Dutch traders kept importing *stomme* well into the eighteenth century. In 1673, *stomme* from Poitou (*Petouwse stomme*) became an official category in the commodity pricelist of the Amsterdam bourse. *Stomme* from Bordeaux (*hooglandsche stomme*), Bergerac, Cognac and St Jean d'Angely was a regularly seen product on the Amsterdam market until 1757. Most *stomme* was sold to local Dutch wine merchants. In the years 1752-1753, an anonymous wine merchant in Middelburg regularly sold barrels of *Hooglandsche* and *Petouwse stomme* to other traders, and the stock of wine merchant Bruynigh in Amsterdam contained a barrel of *stomme* in 1794.¹⁸

A few months after the ban from 1613, the Staten Generaal received a written report by a former Cologne wine merchant, Anthony Becker. He presented himself as a specialist on the subject and possibly was looking for a position as an inspector to execute the stipulations of the ban. In his report he suggested a way to track down *stomme*: to visit every cellar where *stomme* was suspected

¹³ Translation from the Dutch original text by the authors. See: *Tweeden plaacet-bovck inhovdende diversche ordonnancien, edicten, ende plaacete[n] [...] ghepubliceert inden [...] Lande van Vlaendren t'zedert den iaere vyfthien-hondert t'zestich, tot ende metten iaere zesthien-hondert neghenen-twintich*, 6 vols., vol. 2 (Ghendt: Anna vanden Steene, 1629), 611.

¹⁴ Jon Hurley, *A Matter of Taste, A History of Wine Drinking in Britain* (The Mill, Brimscombe Port, Stroud, Gloucestershire: Tempus Publishing Limited, 2005), 222.

¹⁵ Brief van Antonii Becker, 23 oktober 1613, Inventarisnummer 4927, Staten Generaal, toegangnummer 1.01.02, Den Haag, Nationaal Archief (NL-HaNA), Den Haag, <http://www.gahetna.nl/collectie/archief/ead/xml/eadid/2.25.14>; Informatie Antonii Becker, 16-23 oktober 1613, Inventarisnummer 4924, Staten Generaal, toegangnummer 1.01.02, Den Haag, Nationaal Archief (NL-HaNA), Den Haag, <http://www.gahetna.nl/collectie/archief/ead/xml/eadid/2.25.14>.

¹⁶ Notarial deeds were checked at <http://stadsarchief.rotterdam.nl/collectie/notariele-akten> on several occasions in 2017 and 2018.

¹⁷ De Bruyn Kops wrongly translated this passage as 'treading [of] the grapes'. The text however clearly says 'den wijnen gestompt in Conté nantois' – wines stummed in Conté nantois. De Bruyn Kops p. 140 and Stadsarchief Rotterdam, Oud Notarieel Archief inv.nr. 150, deed 97, page 171, 3 April 1634.

¹⁸ Jaarlijkse opgaaf van de wijnen 1760-1794, Inventarisnummer 452, Archief familie Heshuysen, toegangsnummer 225, Amsterdam, Stadsarchief Amsterdam, Amsterdam.

to be stored and to taste all the wines there. He mentions six different ways to detect *stomme* as opposed to real wine¹⁹:

1. *Stomme*, being must and not having undergone fermentation, can still undergo fermentation by sticking a red-hot steel into the barrel with must. The liquid will ferment and turn into low quality wine.
2. *Gemortificieerde* must [must that is worked upon] is to be recognized by its weight. By its impurities it is heavier than normal wines. If wine in a barrel is mixed with *stomme*, a wine sample from the lower part will weigh more than the sample from the upper part.
3. It is recognizable by its greasy [*vettig*] appearance and its very sweet taste, being ten times as sweet as normal wines.
4. *Stomme* is a sticky substance like gum.
5. *Stomme* has a sulphurous smell caused by frequent and immoderate use of burning sulphured wicks in the barrels.
6. Real wines easily mix with each other, but *gemortificieerde* must does not.

Following from Becker's text *stomme* was a liquid with a lot of residual sugar, as he mentions a very sweet and sticky substance. To create a product with high residual sugar, fermentation of the must had to be arrested by some means. And this is also what Becker says: *stomme* is must that did not undergo fermentation. The arrested fermentation could have been achieved by adding distilled alcohol, as is the assumption of several modern authors, mentioned above. But Becker also mentions that *stomme* can be recognized by a sulphurous smell. Since adding sulphur dioxide can indeed arrest fermentation, and assuming *stomme* was indeed created by using some form of sulphur, how exactly did a seventeenth century trader achieve this arrested fermentation? This is described in a French recipe for making *stomme* from Blaye, near Bordeaux, from August 1730:

*Mute wine [le vin muet] is made with must, one starts with 1/3 in a barrel which is then sulphured heavily then two men stir for ¾ hours, when this is done the same quantity of must wine is poured into the barrel, one starts stirring in the same way, then one fills up the barrel and works the wine in the same way as the first times and one pours it over in another barrel. Wine, in this way prepared, does not ferment and keeps its freshness and taste.*²⁰

Since *le vin muet* can literally be translated with *stomme*, it is fair to conclude that this recipe refers to the production of *stomme*. It is here described as must which was prevented from fermenting by burning sulphur above the must. A partial confirmation for this technique seems to come from the Dutch translation of Philip Miller's *Gardener's Dictionary* from 1745:

Stom is nothing more than pure wine, kept from working by transferring it to cleaner barrels, that are strongly fumigated by which it becomes clearer than any other wine, keeping both types of its sediments by precipitating, but if it starts

¹⁹ Letter of 23 October 1613. Den Haag, Nationaal Archief (NL-HaNA), Staten Generaal, toegangnummer 1.01.02, Brief van Antonii Becker, inv.nr. 4927.

²⁰ Translation from the French original text by the authors. See: Bordeaux Métropole, Manuscrits 3292, s.a. Mémoire sur le commerce de Bordeaux, aug. 1730, f.16, 16v. Mentioned in: Wegener Sleswijk, *Franse wijn*, p. 98.

*working as result of neglect it becomes good wine. A bit of muted wine added to over-aged wine makes it ferment again and provides softness.*²¹

Thus *stomme*, according to Millers translator - was pure wine kept from further fermenting by transferring the liquid several times to other barrels that had been fumigated (*belugt*) thoroughly. The process of fumigating meant burning sulphur above or in something, like a barrel. However, the difference between the recipe from Blaye and the mention in the *Groot en algemeen Kruidkundig, Hoveniers, en Bloemisten Woordenboek* is that in the former the liquid was fumigated, in Miller's handboek only the barrels.

Sulphuring barrels

Since the first century BC, wine producers in Gaul decided to store and transport wine in wooden barrels. Barrel storage had economic and logistic advantages over the old practices of wine storage in resin or pitch-sealed amphorae. But storage in wooden barrels also resulted in severe problems: acetic spoilage of the wine or acescence, and other forms of decay. The obvious result was that wine had to be drunk within a short period of a few months to at most a year after production. While there are no sources that tell us exactly how sulphur was used in wine-making in Antiquity, its preservative quality was known. From the mid-15th century sulphur was used in German lands in barrel preparation. In the Holy Roman Empire, under the reign of Frederick III (1415-1493), several imperial decrees forbade the use of sulphur in barrel preparation, thereby implying that sulphur was used. Frederick's successor Maximilian I (1459-1519) relaxed this ban by limiting the use of sulphur to a maximum of one *lot* per *Fuder* of wine.²² How exactly the German technique of sulphuring barrels was transferred to France, has not yet been researched, to our knowledge. We do know however that the English noted use of sulphur in France in 1659. An English traveller, John Lauder, wrote that all French export wine was treated with sulphur to prevent spoilage during its overseas transport. He added that wine drunk at the location where it was originally produced tasted much better than the export version.²³ This citation makes clear that the use of sulphur in the wine production process was customary in seventeenth century France, but only for export wines.

In the Netherlands, the use of sulphur in preparing barrels was called *belugten* (or *beluchten*). This was a treatment of barrels not only done in wine-producing countries for export reasons, but also by wine merchants in the destination countries, at least in the Netherlands. An early-modern advertisement published in Amsterdam in 1710, titled *Onderrechtinge van de kracht / van de geoctroyeerde wyn-lucht* (Explanation of the force / of octroyed wine fumigation) tells of different types of ready-made *lucht* – 'fumes' - used to treat barrels for Rhine wines.²⁴ The text explains that this *lucht* was made of sulphur and prepared with east-Indian spices. All 'earthly stink' could be prevented by the addition of these spices and moreover, the substance was affixed to paper, which prevented smells after burning. Using this preparation, the wine that was later poured in the barrels would become clear and develop a pure flavour and, above all, would be prevented from (re)fermenting in summer. After this introduction, a set of instructions follows. No more than

²¹ The original English version of Miller's book does not include this cited passage. The text of the Dutch eighteenth century edition differs considerably from the original English edition. Therefore, translation by the authors from the Dutch original text (again) to English is a modern version. See: Philip Miller, *Groot en algemeen Kruidkundig, Hoveniers, en Bloemisten Woordenboek* (Leyden: vander Eyk, 1745).

²² This is the equivalent of 32 mg/liter SO₂. See: Arnaud Imméle, *Les grands vins sans sulfite* (Éditions Vinédia, 2012), 39-40; Friedrich Basserman-Jordan, *Geschichte des Weinbaus Unter Besonderer Berücksichtigung Der Bayerischen Rheinpalz* (photographic facsimile), vol. Erster Band (Frankfurt am Main Heinrich Keller, 1907), p. 335-339.

²³ John Lauder, *Journals of Sir John Lauder with his Observations on Public Affairs and other Memoranda 1665 - 1676*, ed. Donald Crawford (Edinburgh: University Press, 1900), 59.

²⁴ Jan Wissing, *Onderrechtinge van de kracht, van de geoctroyeerde wyn-lucht*, (Amsterdam: 1710).

six papers (250 gram) should be burned, attached inside a barrel of approximately 1,100 litres or the pre-metric equivalent of eight Dutch *amen*. After 24 hours, the wine could be poured in, and after 12 to 14 days the result of this 'fumigation' would become apparent. This advertisement shows that barrels for Rhine wine were treated in the Dutch Republic to prevent (re)fermentation in summer. *Beluchten* obviously also lead to some form of revitalisation: better colour and taste. The advertiser, Jan Wissing, claimed that by using paper instead of linen, impurities were masked. The use of sulphured linen, however, became common practice. A late nineteenth century wine merchants' manual for example explains that sulphuring took place by immersing a band of cloth into melted sulphur, thus creating a kind of match.²⁵ This match was stuck to a hook, which was then placed inside the vessel. Next, the match was lit inside the vessel so that fumes were produced while it burnt. In French wine making, this match is still called *alumette hollandaise*, the match from Holland.

Burning sulphur inside an empty barrel was an accepted way of using sulphur, we can conclude. But the recipe from Blaye mentions sulphuring the must. Before we can answer if it is at all possible to achieve an arrested fermentation by either fumigating barrels or burning sulphur above the must, we must look at how the use of sulphur affects the fermentation process.

Sulphur and Sulphur Dioxide

Today, modern chemistry has learned that the presence of sulphur dioxide (SO₂) in must and in finished wine has various interconnected effects. SO₂ is easily produced by burning the natural element sulphur (S), a pale-yellow substance. When burning sulphur in an open vessel partly filled with must, the SO₂ fumes will descend to the surface of the must since SO₂ (64g/mol) weighs more than air (29g/mol). What happens next depends on the acidity level (pH value) of the must. The lower the pH (the higher the acidity level) of the solution, the less SO₂ is needed to destroy the yeast cells. Yeast can only be inactivated by SO₂, entering the cells by a process of diffusion. Once inside the cell the acidic SO₂ converts into the more neutral HSO₃, the yeast cell dies and the conditions for alcoholic fermentation in the must cease to exist. This explains why sulphur was burned above the must and how *stomme* was created. However, this a different technique than pouring must in a heavily fumed barrel as described among others by Millers translator. In order to get the desired result then, the must or wine should have been poured in directly after the fuming. If not, free SO₂ will be absent and it is only in this molecular form SO₂ is effective and will be able to stop fermentation in order to create *stomme*. A way to solve this, was burning very high amounts of sulphur, just as the sources mention.

SO₂ also has the ability to kill bacteria. In wine, SO₂ can destroy the gluconobacter and acetobacter bacteria which, with the aid of oxygen, are responsible for acescence (the formation of acetic acid from ethanol). Yet another function of SO₂ is preventing oxidation of the wine: it can bind certain enzymes and phenolics, preventing browning of the juices. But it also hinders the oxidation of ethanol into acetaldehyde which can cause wine to lose its fruity character.²⁶ Finally, SO₂ binds to anthocyanins in the must, the pigments that are responsible for giving wine its colour, especially in the case of young wines. By lowering the pH-value, the colour red becomes brighter. In older wines, the anthocyanins are bound to tannins. These contain molecules that are more resistant to bleaching.²⁷ Using sulphur in barrels and in *stomme* thus had all kinds of advantages, like the sources

²⁵ *De sleutel van den wijnkelder: eene handleiding voor allen, die belang stellen in de kennis, behandeling en bewaring van verschillende wijnen : voorzien van eene alphabetische lijst van alle wijnsoorten der wereld, met aanduiding van rang, kleur en groeiplaats*, (Schoonhoven: Van Nooten, 1870, 1870).

²⁶ "The Oxford Companion to Wine," 500-501.

²⁷ Richard Gawel, "The Use of Sulfur Dioxide (SO₂) in Wine".

mention: a wine with mixed in *stomme* (that – it must be clear by now – contained a lot of sulphur dioxide) did not oxidate, retained its colour and moreover was sweeter, because of the extra sugar leftovers.

***Stomme* and Sulphured Wines as a Public Danger**

Apart from the desired effects of this operation, however, there were serious disadvantages. Relevant to our *stomme*, the sulphurous aroma of SO₂ irritates the nose membranes and effects the flavour of wine by making it taste harsh and metallic. The threshold at which SO₂ can be detected varies with the type of wine and the consumer; for the average consumer the minimum detectable amount is 200 mg/l in white wine and 100 mg/l in red wine.²⁸ *Stomme* was, according to the French recipe from Blaye, produced by burning sulphur in a vessel which contained must. After stirring the liquid this procedure was repeated several times. It was also possible to create *stomme* by using only heavily fumigated barrels. But then, extremely large doses of sulphur dioxide would have been necessary to create the desired result. The main reason for the passing of the statute of 1613, as given in the statute itself, was that *stomme* endangered public health, because of the impurities it contained. Some eight years after the passing of the statute, in 1621, the Dutch minister Petrus Hondius (1578?-1621) wrote a poem entitled *Dapes Inemptae*, or *Moufe-schans*, extolling the virtues and joys of living in the country. Wine drinking was certainly part of this lifestyle. Hondius talked of wines made with *stomme*; wines that stimulated the will to drink but which did not quench the thirst - and which were responsible for severe headaches the day after.²⁹

In 1636, the Dutch physician Johan van Beverwijck (1594-1647) published a book called *Schat der Gesontheyt* [Treasure of Health]. Van Beverwijck wrote extensively about wine characteristics and warned about wines with a particular and unpleasant smell:

*[...] But those having a strange taste, of the barrel, or after decay, or as if something was mixed in it, very like the sulphured, are all very harmful.*³⁰

It appeared that heavily sulphured wines were certainly not an exception and that they were considered to be dangerous. Forty years later his colleague Jacobus Bontius was quite outspoken about drinking French wines in the tropics:

*[...] that wine merchants in Holland, sending French wines from our native country to these parts, are fumigating these wines in a violent way with a fume they call air [lucht], that consists of a mixture of sulphur, arsenic and resin and which provides the wine with a harmful and burning quality though this air gives a long life to the wine.*³¹

Bontius' statement gives more information than the statement by Van Beverwijck. French wine imported from Holland to the colonies not only contained sulphur, but also impurities such as arsenic and resin. 150 years later, in the mid-19th century, the Dutch chemist Gerrit Jan Mulder explained that wine sent to the tropics, in this case the Dutch East Indies, was more heavily sulphured than was

²⁸ "The Oxford Companion to Wine," 666-667.

²⁹ Petrus Hondius, *Dapes Inemptae of de Moufe-Schans, Dat Is, de Soetichheydt Des Buyten-Levens, Vergheselschap Met De Boucken* (Leyden: Daniel Goels, 1621), p. 33.

³⁰ Translation from the Dutch original text by the authors. See: Johan van Beverwijck, *Schat der gesontheyt. Uit: Alle de wercken* (Amsterdam: Ian Jacobs Schipper, 1660), 139.

³¹ Translation from the Dutch original text by the authors. See: Jac. Bontius, *Oost- en West-Indische Warande*, ed. George Margrav & Willem Piso (Amsterdam: Jan ten Hoorn, 1694), 26-27.

customary.³² The elemental sulphur that was used to produce sulphur dioxide (SO₂), could very well contain arsenic as an impurity. Another 19th century source mentioned this possibility and described ways to detect arsenic sulphur.³³ The mention of resin in wine is also interesting. Resin is the oldest antiseptic used in wine-making and is still used to produce retsina wines in Greece. Resin was also used to produce pitch, used to seal wine amphorae in the Roman era and later commonly used to seal wooden barrels and prevent oxidation. It is possible that those barrels sent to the tropics were heavily smeared with pitch, thus influencing the flavour of the wine. Bontius ended his statement about the impurities in French wines imported from Holland by declaring that he witnessed people dying suddenly just by drinking such wines. Whether this is true or not, it is evident that he had a deep distrust in the health claims made about these wines.

The danger of using wines treated with sulphur also entered a seventeenth century Dutch cookbook. The opening remarks of *De Verstandige Kock* [The Sensible Cook], first printed in 1667 but clearly leaning on older material, warn against using certain sweet wines in sauces:

*The sensible cook warns all cooks to beware of adding strong **sweet French** wines in sauces, because these wines, amongst them wines from Langon, from the Haut Pays and 'Haentjeswijn', will become bitter instead of sweet once warmed on the fire. Because of this, the sauces to which these wines are added, are spoiled. However, if one wants to use wine, one has to take Rhine wine, or, if not available, French wines **which still are fermenting**, so more acedid in taste, like wines from Tursan, Cognac or from 'Coutouwe', or else red wine from the vicinity of Paris.*³⁴

The author of this cookbook is unfortunately not known, so we don't know how well he or she knew wine making. But the mention of the taste turning bitter strongly suggests the metallic and harsh taste sulphur can give to wine. The advice that cooks should use wines which were still fermenting also clearly suggests that the mentioned wines, from Langon, the Haut Pays (hinterland of Bordeaux) and Gaillac (*Haantjeswijn*) were not and therefore contained a large amount of sulphur dioxide, likely in the form of *stomme*. Whether those from Tursan, Cognac or the 'coteaux' (possibly Coteaux d'Anjou) really were not treated remains to be seen. However, the warning in the cookbook is clear.

In the extended edition of Chomel and De Chalmot's encyclopaedia (1778) De Chalmot explained that ordinary white wine cannot be stored without sulphuring the barrels. He explained this practise as a necessary if minor evil.³⁵ However:

[...] quite a few imposters resorted to sulphur to flavour and colour their low-quality white wines. Under the pretence of the necessity of sulphuring they burned an immoderate and huge quantity of sulphur in their barrels. [...] A wine reveller drinking such a liquid will be punished by a dry tongue [...] and feverish symptoms followed by rash and pimples. The wine, normally a cheering liquid, leads to anger

³² Gerardus Johannes Mulder, *De wijn scheikundig beschouwd* (Rotterdam: Kramers, 1855), 79-80.

³³ Van Berchtold & Randnitz, "Middelen ter vervalsching van de wijnen en wijze hoedanig die te ontdekken," *Tijdschrift voor handel en nijverheid, zamengesteld zoowel ten behoeve van burgerlijke ingenieurs, architecten en industrieën als ten algemeenen nutte voor fabrieken en daarmede in verband staande bedrijven* 2, no. 7-12 (1845): 15.

³⁴ Translated by the authors from the facsimile edition in: Marleen Willebrands, Alexandra van Dongen en Manon Henzen, *De Verstandige Kock*, Gorredijk, Sterck & de Vreese, 2022.

³⁵ The original French author Noel Chomel published his work for the first time in 1709. In 1743 his work was translated into Dutch. In 1768 Jacques de Chalmot, bookseller and publisher in Leeuwarden, made an extended contribution to the original work. See the justification to the digital edition of Noel M. Chomel, *Huishoudelyk woordboek*.

*and rage. It creates anger instead of joy, headaches instead of spirit, palpitations for laughter.*³⁶

Though there was no mention of *stomme*, De Chalmot was clear about the health risk of heavily sulphured wine. De Chalmot ended his entry on sulphuring by stating that since all white wines were sulphured, sometimes to an unhealthy level, one should avoid drinking white wines on a daily basis. Anne Wegener Sleeswijk has pointed to shifting Dutch wine consumption preferences, from white to red wines, slightly before 1750. At the end of the eighteenth century the transition was fully complete.³⁷ It is not possible to discuss her reasons for this conclusion here, but it is an intriguing suggestion that the collective distaste and move away from drinking heavily sulphured white wines could have also resulted partly because of the health risks involved in drinking white wine, facilitating a transition from white wine preferences to red.

The use of sulphur in wine was heavily criticized by several authors because of its health risks, as we have seen now. A final example is an eighteenth-century survey about the possibilities of expanding viticulture in the south-western French regions of Béarn, Basse Navarre and Le Labour. The author of the survey is very outspoken on the relationship between sulphur (*soufre*), *stomme* (*vin muet*) and health risks. The survey stated that the wine produced in the valleys of those regions was of very poor quality, without body and with a very bad flavour. This wine could only be preserved for longer than a year by using dangerous amounts of sulphur or other equally dangerous substances. If it was adulterated [in French: *frélater*] for export reasons with *stomme* (*vin muet*) to hide its green taste, it would have a very bad influence on the sales potential of the higher-quality wines in those regions. *Stomme* was described as a truly harmful pestilence of which the author was very reluctant to divulge the composition; physicians regarded this liquid as the cause of illnesses that could lead to death.³⁸ Here, *stomme* was clearly linked to export and its usage in a blend with low quality wines to improve wine flavour. Above all else it was regarded as a dangerous and poisonous liquid.

Reviewing the body of our examined historic texts, all the authors had a negative opinion about *stomme* or heavy sulphuring in relation to health aspects. In this respect their opinions were in line with the text of the statute issued by the States General. Modern research moreover agrees with the historical criticism. In a re-evaluation by the European Food Safety Authority (EFSA) a daily quantity sulphur of 0,7 mg per kg bodyweight of sulphur dioxide [SO₂] is considered harmless for most people.³⁹ Up to four permille of the Dutch population can show some kind of intolerance to sulphites.⁴⁰ Some people have mild reactions; others are affected more severely. Symptoms include palpitations, skin complaints like nettle rash, and anaphylaxis in different gradations such as tingling in the mouth and nose, asthma, low blood pressure and shock. Sulphite leads to reactions, already

³⁶ Translation from the Dutch original text by the authors. See: N. Chomel & J.A. De Chalmot, *Algemeen huishoudelijk-, natuur-, zedekundig- en konstwoordenboek: vervattende veele middelen om zijn goed te vermeerderen en zijne gezondheid te behouden*, vol. 7 (Leyden, Leeuwarden: Joh. le Mair, J.A. de Chalmot, 1778), 4248.

³⁷ Wegener Sleeswijk, *Franse wijn*, p. 106-107.

³⁸ "Lettre écrite de Bayonne du 30 Décembre 1755, sur la trop grande multiplication de la vigne," *Journal oeconomique ou mémoires, notes et avis sur l'agriculture, les arts ...* (1756, Février): 79-81.

³⁹ "Re-evaluation of sulfur dioxide," *EFSA Journal* 14 (4): 4438 (2016).

⁴⁰ Sulphite is an all-purpose word for certain sulphur compounds. Nowadays they are added to food and drink as a preservative. They are added to retain flavour and colour, to prevent bacterial growth and browning. They are labelled by code numbers (220 sulphur dioxide, 221 sodium sulphite, 222 sodium bisulphite, 223 sodium metabisulphite, 224 potassium metabisulphite, 225 potassium sulphite, 228 potassium bisulphite).

visible after two to fifteen minutes, is the conclusion.⁴¹ Looking at these modern-day effects of sulphites on our health, it is clear that the early-modern and 19th century discourses about the dangers of *stomme* and heavily fumigated barrels, lead us to conclude that *stomme* was made by using sulphur, not by adding alcohol, as some modern authors explain. The extreme use of sulphur in the production of *stomme* on the one hand and in barrel preparation on the other hand, led to intolerances for many people, and to adverse effects or allergic symptoms in differing degrees. It might even have led to death.

Summary and Conclusion

The *stomme* of Dutch sources and the early modern *vin muet* of French sources was a product created by burning large doses of sulphur in a barrel with fresh must, thereby creating a sweet liquid. It was also possible to create *stomme* by pouring must in a freshly fumigated barrel. The amount of sulphur then needed to have been even higher. The sulphur or brimstone could contain arsenic and other impurities, both precipitating into the liquid or leaving traces in the barrels, thereby severely contaminating the wine. Also, the burned sulphur itself could, as SO₂, be considered an impurity. This *stomme* or *vin muet* was extensively used by Dutch wine merchants in preparing weak wines for transport, but also to refresh the same weak wines before selling them on the market.

As implied by several sources of the seventeenth and eighteenth century, drinking white wines could create severe health problems. This was caused by the practice of heavily sulphuring barrels or must to create *stomme* and by adding *stomme* to the white wines. *Stomme* in itself was never a 'wine' to drink on its own. Considering that the preference in the Netherlands in the seventeenth and a greater part of the eighteenth century was for sweet white wines, and that *stomme* was used to turn low-quality French white wines into sweeter and more palatable wines, *stomme* was a real factor endangering public health.⁴² The use of *stomme* and heavily sulphurised wines led to complaints that we now recognize as symptoms of sulphite intolerance. The large doses of sulphur dioxide that were applied could certainly have increased intolerances or adverse effects.

The 1613 ban on *stomme* was to our knowledge never revoked officially, but nevertheless trade in *stomme* continued and flourished. The ban was clearly not in the interest of the Dutch wine trade and therefore the enforcement of a prohibition on *stomme* was hardly possible.⁴³ Repudiation of sulphured wine was not part of the dominating attitude of the wine trade, since *stomme* was a commodity frequently mentioned in the wine price lists (*pryscouranten*) in Amsterdam, and we came across *stomme* in the stock lists of at least two wine merchants. Treating wine with *stomme* and burning sulphur in barrels was seen as a necessary process in the wine trade, to keep weak French wines from spoiling en route and to refresh and sweeten those same weak wines while in the Dutch cellars. The public realized however that those white wines had negative effects on health, which may have helped in the shift of wine consumption from white to red. The ban of 1613 can be seen in

⁴¹ M.K. Bekker and T. Rustemeyer, "Sulfietintolerantie, een overzicht van pathogenese, diagnose en behandeling," *Nederlands tijdschrift voor allergie* 9, no. 4 (2009); Y. Kon and Th. Rustemeyer, "Allergeen van de maand, metabisulfiet," *Nederlands tijdschrift voor dermatologie en venereologie* 25, no. 01 (2015).

⁴² It must be pointed out that making and using *stomme* strongly resembles the use of a sweetening agent in Germany known from the 1970s and 1980s, the Süssreserve. This was also produced by adding high doses of sulphur dioxide. See: "The Oxford Companion to Wine," 670-671.

⁴³ For a historic explanation on the relation between legal rules and product quality, see: Alessandro Stanziani, "Products, norms and historical dynamics, Quality: A Debate, edited by C. Musselin and C. Paradeise," *Sociologie du travail* 47: S114-123 (2005): 115-116. Peter Atkins explains that ineffectiveness of food laws was linked to interest of related parties, the variability of systems of enforcement (Dutch early modern cities were quite autonomic), a lack of consensus about standards and finally existing jurisprudence, see: Peter J. Atkins, "Social History of the Science of Food Analysis and the Control of Adulteration," in *The Handbook of Food Research*, ed. Anne Murcott, Warren James Belasco & Peter Jackson (London, New York: Bloomsbury Publishing, 2016), 102.

hindsight as a first attempt in the Netherlands to protect the public from the dangers of sulphite intolerance.