

COMMISSION OF THE EUROPEAN COMMUNITIES

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COMMISSION REPORT
ON THE PRESENT STATUS OF SCIENTIFIC KNOWLEDGE AND TECHNOLOGICAL
DEVELOPMENT REGARDING THE USE OF SULPHUR DIOXIDE FOR MAKING WINE

PROPOSAL FOR A
COUNCIL REGULATION (EEC)
amending Regulation (EEC) No 337/79 as regards maximum
total sulphur dioxide levels in wines other than
sparkling and liqueur wines

(submitted by the Commission to the Council)

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I. Introduction

The use of sulphur dioxide in the manufacture of wine is authorized in the Community under certain conditions. The form in which sulphur dioxide may be added to wine is defined in Annex III to the basic Regulation on wine (EEC) No 337/79¹. In addition, the maximum levels of total sulphur dioxide are laid down in Article 44 of the same Regulation for all wines except sparkling wines and liqueur wines, in Articles 12 and 16 of Regulation (EEC) No 358/79² for sparkling wines and quality sparkling wines and in Article 13 of Regulation (EEC) No 338/79³ for quality sparkling wines produced in specified regions. The maximum authorized levels differ according to the category of wine and the residual sugar content; they apply at the time the wine is placed on the market for direct human consumption.

Council Regulation (EEC) No 1697/77⁴ provided, with effect from 1 September 1978, that the maximum contents of sulphur dioxide in all wines other than sparkling wines and certain wines produced in special conditions, be reduced by 25 mg/l. Bearing in mind that the level of additives in foodstuffs should be kept to the strict minimum required for manufacturing purposes, this lowering of the maximum values was regarded as an intermediate step on the way to further limitations on the use of sulphur dioxide in winemaking. Accordingly, in Regulation (EEC) No 1697/77, the Council provided for total sulphur dioxide levels to be reduced by not less than 25 mg/l by 1 September 1981, "in so far as scientific knowledge and technological development allow". For this purpose, the Commission was asked to submit a report and appropriate proposals.

¹OJ L 54, 5. 3.1979, s. 1.

²OJ L 54, 5. 3.1979, s. 130.

³OJ L 54, 5. 3.1979, s. 48.

⁴OJ L 187, 27. 7.1977, s. 15.

The provisions of this Regulation have been incorporated, in the process of consolidation of Council Regulations on wine, in Regulations (EEC) Nos. 337/79, 338/79 and 3587/79.

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FOR MAKING WINE

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In response to the Council's instruction, the Commission submits the present report and the appended proposal for an amendment of Regulation (EEC) No 337/79. For this purpose it has taken account of a study prepared at its request by a number of scientific experts and has consulted the Scientific Committee for Foodstuffs. Extracts from this Committee's Opinion delivered on 15 January 1981 are given at the end of this report.

II. Scientific knowledge and technological development regarding the use of sulphur dioxide for making wine

1. Purpose, effects and forms of SO₂ addition

Sulphur dioxide has to be used in winemaking in order to maintain the organoleptic properties of wine over a fairly lengthy storage time. The reason why preference is given to sulphur dioxide for this purpose is that it can perform several functions in wine simultaneously and, in this respect, has so far proved to be irreplaceable by any other permitted wine adjuvant or other chemical compound. In particular it fulfils the following functions:

- (a) antiseptic effect
- (b) enzyme-inactivating effect
- (c) reducing (anti-oxidant) effect
- (d) lixiviating effect (extraction of water-soluble substances)
- (e) flavour-influencing effect.

Whereas wine yeasts are relatively insensitive to SO₂, low sulphite doses can destroy acetobacter, wild yeasts and moulds. For this reason, even small quantities of SO₂ provide protection against undesired infections by lactic acid bacteria or help to improve wines already affected. Sulphite inhibits undesirable enzymatic oxidation of phenol wine constituents, melanoid formation and non-enzymatic oxidation of colouring matters: in a word it maintains and improves the colour of wine.

⁺SO₂ is used here to mean sulphur dioxide or any sulphite forms found in wine.

The combination of aldehydes and ketones with sulphite improves the organoleptic properties of wine. The effect is particularly important in white and rose wines, in which SO_2 neutralizes what is considered to be the deleterious effect which free acetaldehyde has on the flavour and aroma of these wines.

As a preserving agent in the conventional sense, SO_2 is of no importance in wine. The quantities of SO_2 which are required in order to kill yeasts and thus give wine a long storage life are many times in excess of the maximum levels permitted by the Community. Moreover, over-sulphited wines present a pungent aroma and sour taste which makes them unpalatable for the consumer.

The SO_2 content of wine usually originates exclusively from additions made during the winemaking process. In some cases, however, there may be some natural formation of variable quantities of SO_2 during fermentation. In this connection, factors such as the composition of the starting material, the pre-treatment of the must, the conditions and management of fermentation (type of wine yeast) all play a role. Furthermore, it appears that this phenomenon of the natural formation of SO_2 is confined almost exclusively to the northern wine-growing areas of the Community.

The form in which added SO_2 may be found in the finished wine varies and is independent of the form in which it was originally added (SO_2 gas or potassium compound). Basically, there are two different forms in which it occurs: free SO_2 and combined SO_2 . The sum of the quantities in these two forms gives the total SO_2 content, for which - as mentioned earlier - the Community has laid down maximum values. At the time when the SO_2 is added to the wine it is "free" form, or one of the various "sub" forms (in solution, as H SO_3 - bisulphite ion - or SO_3 - sulphite ion). All three forms can occur together, in which case the relative proportions depend on the pH value and temperature. Broadly speaking, the antisepic effect is derived from SO_2 in solution and the reducing effect from H SO_3 , whereas SO_3 is neither quantitatively nor qualitatively important.

However, the most important reaction of the added SO_2 in quantitative terms is not the abovementioned breakdown of free SO_2 into the various sub-form, but the combination of SO_2 with various constituents present in the wine (combined SO_2). In the finished wine these newly formed compounds with aldehyde (acetaldehyde), ketone (diacetyl, acetoin) and keto acids (pyruvate, α -ketoglutarate), most of which result from yeast metabolism, make up 50-80% of the combined SO_2 . Smaller quantities of SO_2 are combined with various reducing sugars, the remainder - up to 40% - with hitherto unidentified wine constituents, probably higher aldehydes and ketones. The rate of combination, i.e. the capacity of SO_2 to combine, differs markedly according to the characteristic equilibrium constants of the substances concerned. Of the various SO_2 binding substances, a distinction must be made between the following:

- substances which bind only part of the SO_2 , i.e. which present high equilibrium constants (e.g. D-glucuronic acid);
- substances which bind almost all the SO_2 , i.e. which present very low equilibrium constants (e.g. acetaldehyde).

Of all the sulphite additive compounds known so far, the compound with acetaldehyde is the most reliable because acetaldehyde has the smallest equilibrium constant.

The question of which binding properties the reaction partner presents and in what quantity it is present in wine is of central importance for the production of low- SO_2 wines. Strictly speaking, only relatively small quantities of SO_2 would be necessary to achieve the desired effects in wine - for which in fact the free SO_2 is solely responsible. The reason why in practice these minimum values have to be exceeded considerably is that by far the largest share of added SO_2 begins by combining properties - and is thus immediately immobilized in a fairly inactive form. To achieve the desired protective effect, therefore, more SO_2 must be added in a quantity large enough to arrive at the necessary concentration of effective (free) SO_2 .

Substances with a low equilibrium constant, especially those which combine with almost all the available SO_2 (e.g. acetaldehyde), are therefore undesirable in wine because they immobilize quantities of SO_2 (ballast SO_2).

Thus, it seems that the more SO_2 immobilizing agents there are present in the wine, the more free SO_2 is required and, hence, the greater the total sulphur requirement of a wine. In order to safeguard the sensory properties over a fairly long storage period, higher values of free SO_2 are required in the case of white and rosé wines than in the case of red wines.

2. Natural modification of SO_2 content during aftercare, transport and storage

It must be pointed out that the quantity of SO_2 in the finished, bottled wine is not the same as the quantity originally added or the quantity that might have been formed during fermentation. Normally, the level of SO_2 drops during the production process, transport and storage of wine. In some cases, the differences in level can be considerable.

The decrease in the level of SO_2 is explained mainly by oxidation of the SO_2 to sulphate, in which case atmospheric oxygen (as a result of the wine with the air) or oxygen physically dissolved in the liquid is transferred to SO_2 . The quantity of resulting sulphate is, however, never equivalent to the quantity of SO_2 that disappears: the amount of sulphate produced is always less than would theoretically be assumed. It is presumed that the remaining SO_2 that has disappeared forms compounds with (so far unidentified) wine constituents and escapes detection by analysis.

In order to maintain a sufficiently high level of effective (free) SO_2 , it is necessary - at least until the wine is bottled - to maintain continuous monitoring of the SO_2 content and, in some cases, add a little more.

The fact that the SO₂ content can change considerably in the course of aftercare and storage of wine, without any interference from outside, is taken into account in the Community rules. They specify that the maximum levels of SO₂ apply "at the time the wine is placed on the market for direct human consumption". In the preceding stages of production, therefore, the limit values can be exceeded.

3. Technological possibilities for reducing the SO₂ content of wines

Despite progress in oenological research in recent years, it is impossible at the present time to dispense completely with SO₂ in winemaking and aftercare. As stated earlier, there are at present no known substitute chemicals which would be capable of performing all the functions of SO₂.

If the use of SO₂ is completely dispensed with in winemaking, radical changes occur - except in special wines such as liqueur or dessert wines - in the sensory properties of the wine. The wine presents an aroma and flavour of aldehyde, which is regarded as a defect. In addition, there may be growth of micro-organisms and, consequently, dramatic changes in the product. In some cases, there is formation of substances which are not absolutely safe from the health point of view.

Consequently, since SO₂ cannot be completely dispensed with at the present stage, it must be the main concern of the wine industry to produce wines with a minimum level of SO₂, and, by further development of winemaking technology, to pave the way for further reduction in the SO₂ content of wines. In this connection, there are three separate factors to be considered:

1. Prevention of formation of SO₂-immobilizing substances.
2. Removal of SO₂-immobilizing substances.
3. Removal of SO₂ together with its immobilizing partners.

3.1 Possibilities for preventing the formation of SO₂ immobilizing substances

As said earlier, by far the biggest share of SO₂ in wine is bound to a number of constituents. For the most part, these substances are formed by micro-organisms. Their concentration can differ very considerably from one wine to another. Binding partners are formed principally during the following two stages:

- during ripening of the grapes, in which case grape variety, conditions of growth and ripening and formation of rot are of major importance;
- during fermentation, which case species of yeast, the course of fermentation, and, in some cases, the development of bacteria play a decisive role.

In the light of the available data on the complex mechanisms of the formation of SO₂-binding agents and the possibilities of influencing them, endeavours to keep the SO₂ content down should be focussed on the following (theoretical) objectives:

- selection of grape varieties with a low content of polyphenol-oxidizing and pectolytic enzymes and catechins and their oligomers
- protection of grapes against attack by micro-organisms, in particular *Botrytis cinerea* (exception: some quality wines owe their characteristic properties to *Botrytis* and this case mould attack of the grapes is desirable);
- production of grape musts which contain a sufficient level of substances having a favourable effect on acid and yeast growth and nitrogen compounds;

- fermentation under controlled conditions, maintenance of specific temperatures, even distribution of yeast in fermentation material;
- use of selected fermentation yeasts entailing the formation of very little SO_2 , H_2S (hydrogen sulphide), acetaldehyde, pyruvate and ketoglutarate;
- protection of wine against contact with oxygen;
- prevention of microbial activity in wine.

Great efforts have been made in the field of wine technology in the past in order to meet the abovementioned objectives; they have entailed - to name only a few - improvements in the winemaking process, special pre-fermentation treatments, must pasteurization, breeding of more suitable fermentation yeast, improvements in fermentation process, more frequent use of inert gases, sterile filtration and modern SO_2 -economizing bottle-filling methods. By the systematic application of these methods, it has been possible to reduce the quantity of SO_2 used in wine making. However, in practice it always happens that one or more factors cannot be influenced. Thus, despite observation of all the rules, it is still a fact that wine has a high SO_2 requirement.

3.2 Possibilities for removing SO_2 -binding substances

A number of experiments have been carried out on this aspect in recent years. Efforts have been focussed almost entirely on the physical, chemical, enzymatic or biological breakdown of free acetaldehyde. Broadly speaking the outcome is that in practice it is impossible at the present stage to break down acetaldehyde by physical, chemical or enzymatic methods. However, the biological approach offers definite possibilities, through the agency of "biological acid breakdown" (lactic acid fermentation). In the course of biological acid breakdown it is possible, depending on the bacterial strain, to metabolize a certain quantity of acetaldehyde and other SO_2 binding substances. This ability on the part of the lactic acid bacteria can only be exploited however in the case of red wines because biological acid breakdown is undesirable in white wines, for organoleptic reasons, and in fact measures have to be taken to prevent the process in such wines.

3.3 Possibilities for removing SO₂ with binding partners

Of the various methods whereby SO₂ in its principal combined form (Oxyethane sulphonic acid) can be precipitated or absorbed, electro dialysis is the only effective technique known so far. However, this method which was initially used experimentally to improve tartar stability, produces a significant change in the analytical picture of the treated wine. Furthermore, the method is expensive to use. Since other methods of tartar stabilization have recently come to the forefront (contact method), electro dialysis treatment is probably less promising on the whole.

III. Opinion of the Scientific Committee for Foodstuffs, of 15 January 1981 on the effects on health of ingestion of sulphur dioxide and other sulphur dioxide and other sulphuring agents (extract)

The Scientific Committee for Foodstuffs was asked to adopt a position on this matter.

"The Committee was provided with a number of extensive reports on the problem of the use of sulphiting agents in food and beverages. These included a report by Professor Jaulmes on the safety of these substances, a publication of the Federation of American Societies for Experimental Biology (FESAB), reports by F W Beech, C Cantarelli, D Jakob and P Sudraud on the technological possibilities for reducing sulphur dioxide in wine, and a report by F Custot setting out the legally permitted and actually detected levels of SO₂ in food within the EEC.

The Committee concluded that for the great majority of the population no hazard to health would arise from the ingestion of sulphites at levels currently found in food and beverages. Nevertheless, the Committee wishes to reemphasize its previously stated opinion, applicable to all food additives, that their use should be restricted to the minimum level necessary technologically, particularly in foods which are an important source of thiamin."

IV. Conclusions

Sulphur dioxide is a substance which has so far proved irreplaceable by any other substance in wine preparation. The special importance of sulphur dioxide lies in the fact that it accomplishes a large number of desirable functions in wine and is indispensable for maintaining the sensory properties of almost all wine. Strictly speaking, these effects could be accomplished with a relatively small quantity of SO₂. However, wine contains a number of ingredients which bind SO₂ immediately and immobilize it in an inactive form. Consequently, in practice, depending on the concentration and nature of the immobilizing agents, quantities of SO₂ well in excess of the effective threshold are necessary. For this reason, in previous years, scientific research has laid special emphasis on exploring the relationship involved in SO₂ binding, with the object of producing wine with a lower SO₂ requirement by improving or developing new methods of production. On this point, considerable progress has been made. The most successful approach so far has proved to be the prevention of the formation of SO₂-immobilizing agents by appropriate techniques.

In practice, however, account always has to be taken of the fact that one or several parameters cannot be influenced. Thus, despite application of all the rules, it happens constantly that in individual cases wines have a high SO₂ requirement. Problems arise particularly when wines are made from grapes which already contain considerable quantities of SO₂-binding substances and where treatment supplied during the subsequent making of the wine can only improve matters slightly. This case occurs in particular with certain types of wine whose characteristic quality features are attributed to the use of grapes attacked by the mould "Botrytis cinerea".

On the question of applying scientific knowledge in practice and the adoption of moderne manufacturing techniques, the following general remark must also be made: in the large majority of winemaking establishments, which include many small and medium-sized undertakings, a considerable periode of time will be required before the new technologies can be mastered. Furthermore, the necessary investment in the new equipment presents financial problems which cannot be readily overcome, particularly by the smaller firms. Nonetheless, winemakers in the past have made substantial efforts to comply with the call for more sparing use of SO₂.

So it can be assumed today - and representative sample surveys bear this out - that wine in the Community on average contains considerably less SO_2 than is authorized by law.

In the light of the foregoing and the opinion of the Scientific Committee for Foodstuffs, the Commission concludes that it is justifiable to lower the maximum limit for total sulphur dioxide in wines by 25 mg/l.

However, it considers that the higher limit values which apply at present for certain quality wines should be maintained. In this connection, account is taken of the fact that these wines require higher SO_2 content on account of their composition. Likewise, the Commission does not think it appropriate at the present time to lower the maximum SO_2 values applying to sparkling wines, quality sparkling wines and quality sparkling wines produced in specified regions.

Proposal for
COUNCIL REGULATION (EEC)

amending Regulation (EEC) No 337/79 as regards maximum total sulphur dioxide levels in wines other than sparkling and liqueur wines

THE COUNCIL OF THE EUROPEAN COMMUNITIES,

Having regard to the Treaty establishing the European Economic Community,

Having regard to Council Regulation (EEC) No 337/79 of 5 February 1979 on the common organisation of the market in wine (1) as last amended by Regulation (EEC) No 3456/80 (2) and in particular Article 44(5) thereof,

Having regard to the proposal from the Commission,

Whereas the maximum sulphur dioxide levels for wines intended for direct human consumption other than sparkling and liqueur wines were fixed by Article 44 of Regulation (EEC) No 337/79:

Whereas, pursuant to the above-mentioned Article, the Council asked the Commission to draw up a report on scientific knowledge and technological development in respect of the use of sulphur dioxide in oenology, for the purposes of reducing maximum total sulphur dioxide levels in wines;

Whereas this report shows that a reduction in the said maximum levels is compatible with present-day oenological knowledge and technological progress in respect of the majority in wine types: whereas, for the purposes of limiting the use of all food additives as far as possible, a reduction in maximum total sulphur dioxide levels of 25 milligrams per litre should be introduced for all wines with the exception of certain wines with special characteristics and of sparkling wines;

(1) OJ No L 54, 5. 3.1979, p.1

(2) OJ No L 360, 31.12.1980, p.18

Whereas provision should be made for a period for the purposes of facilitating adaptation to the levels laid down in this Regulation: whereas, accordingly, the new limits should apply with effect from 1 September 1982; whereas, at the same time, provision should be made for the Commission to adopt transitional measures for wines produced before that date;

HAS ADOPTED THIS REGULATION:

Article one

Article 44 of Regulation (EEC) No 337/79 is hereby amended as follows:

1. Paragraph 1(a) and (b) is replaced by the following:

"(a)150 milligrams per litre for red wines;

(b)200 milligrams per litre for white and roséwines"

2. Paragraph 2(a) is replaced by the following:

"(a)200 milligrams per litre for red wines and 250 milligrams per litre for white and rosé wines".

3. In paragraph 6, "1 September 1978" is replaced by "1 September 1982".

Article 2

This Regulation shall enter into force on the third day following its publication in the Official Journal of the European Communities.

It shall apply with effect from 1 September 1982.

This Regulation shall be binding in its entirety and directly applicable in all Member States.

Done at /Brussels)

For the Council

