AZOXYSTROBIN

methyl (E)-2-{2-[6-(2-cyanophenoxy)pyrimidin-4-yloxy]phenyl}-3-methoxyacrylate
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FAO specifications are developed with the basic objective of promoting, as far as practicable, the manufacture, distribution and use of pesticides that meet basic quality requirements.

Compliance with the specifications does not constitute an endorsement or warranty of the fitness of a particular pesticide for a particular purpose, including its suitability for the control of any given pest, or its suitability for use in a particular area. Owing to the complexity of the problems involved, the suitability of pesticides for a particular purpose and the content of the labelling instructions must be decided at the national or provincial level.

Furthermore, pesticides which are manufactured to comply with these specifications are not exempted from any safety regulation or other legal or administrative provision applicable to their manufacture, sale, transportation, storage, handling, preparation and/or use.

FAO disclaims any and all liability for any injury, death, loss, damage or other prejudice of any kind that may arise as a result of, or in connection with, the manufacture, sale, transportation, storage, handling, preparation and/or use of pesticides which are found, or are claimed, to have been manufactured to comply with these specifications.

Additionally, FAO wishes to alert users to the fact that improper storage, handling, preparation and/or use of pesticides can result in either a lowering or complete loss of safety and/or efficacy.

FAO is not responsible, and does not accept any liability, for the testing of pesticides for compliance with the specifications, nor for any methods recommended and/or used for testing compliance. As a result, FAO does not in any way warrant or represent that any pesticide claimed to comply with a FAO specification actually does so.

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1 This disclaimer applies to all specifications published by FAO.
INTRODUCTION

FAO establishes and publishes specifications* for technical material and related formulations of agricultural pesticides, with the objective that these specifications may be used to provide an international point of reference against which products can be judged either for regulatory purposes or in commercial dealings.

From 2002, the development of WHO specifications follows the New Procedure, described in the 1st edition of “Manual for Development and Use of FAO and WHO Specifications for Pesticides” (2002) and amended with the supplement of this manual (2006), which is available only on the internet through the FAO and WHO web sites. This New Procedure follows a formal and transparent evaluation process. It describes the minimum data package, the procedure and evaluation applied by FAO and the Experts of the FAO/WHO Joint Meeting on Pesticide Specifications (JMPS). [Note: prior to 2002, the Experts were of the FAO Panel of Experts on Pesticide Specifications, Registration Requirements, Application Standards and Prior Informed Consent, which now forms part of the JMPS, rather than the JMPS.]

FAO Specifications now only apply to products for which the technical materials have been evaluated. Consequently from the year 2000 onwards the publication of FAO specifications under the New Procedure has changed. Every specification consists now of two parts, namely the specifications and the evaluation report(s):

Part One: The Specification of the technical material and the related formulations of the pesticide in accordance with chapters 4 to 9 of the “Manual on development and use of FAO and WHO specifications for pesticides”.

Part Two: The Evaluation Report(s) of the pesticide, reflecting the evaluation of the data package carried out by FAO and the JMPS. The data are provided by the manufacturer(s) according to the requirements of chapter 3 of the “FAO/WHO Manual on Pesticide Specifications” and supported by other information sources. The Evaluation Report includes the name(s) of the manufacturer(s) whose technical material has been evaluated. Evaluation reports on specifications developed subsequently to the original set of specifications are added in a chronological order to this report.

FAO specifications developed under the New Procedure do not necessarily apply to nominally similar products of other manufacturer(s), nor to those where the active ingredient is produced by other routes of manufacture. FAO has the possibility to extend the scope of the specifications to similar products but only when the JMPS has been satisfied that the additional products are equivalent to that which formed the basis of the reference specification.

Specifications bear the date (month and year) of publication of the current version. Dates of publication of the earlier versions, if any, are identified in a footnote. Evaluations bear the date (year) of the meeting at which the recommendations were made by the JMPS.

* NOTE: PUBLICATIONS ARE AVAILABLE ON THE INTERNET AT (http://www.fao.org/agriculture/crops/core-themes/theme/pests/pm/jmps/ps/en/) OR IN HARDCOPY FROM THE PLANT PROTECTION INFORMATION OFFICER.
**PART ONE**

**SPECIFICATIONS**

AZOXYSTROBIN

### PART ONE

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<td>AZOXYSTROBIN AQUEOUS SUSPENSION CONCENTRATE (AUGUST 2009)</td>
<td>8</td>
</tr>
</tbody>
</table>
ISO common name:
Azoxystrobin (E-ISO, BSI)

Chemical name(s):
- IUPAC, methyl $(E)$-2-{2-[6-(2-cyanophenoxy)pyrimidin-4-yloxy]phenyl}-3-methoxyacrylate
- CA, methyl $(E)$-2-{[6-(2-cyanophenoxy)-4-pyrimidinyl]oxy}-α-(methoxymethylene) benzeneacetate (9CI)

Synonyms:
none

Structural formula:

![Structural formula of Azoxystrobin]

Molecular formula:
$C_{22}H_{17}N_3O_5$

Relative molecular mass:
403.4

CAS Registry number:
131860-33-8

CIPAC number:
571

Identity tests:
GC retention time; IR spectrum
Typical IR spectrum of Azoxydrobin

<table>
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<tr>
<th>Peak</th>
<th>Wavelength cm(^{-1})</th>
<th>Peak</th>
<th>Wavelength cm(^{-1})</th>
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</thead>
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</tr>
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</table>
AZOXYSTROBIN TECHNICAL MATERIAL

FAO specification 571/TC (August 2009)

This specification, which is PART ONE of this publication, is based on an evaluation of data submitted by the manufacturers whose names are listed in the evaluation reports (571/2007 and 571/2009). It should be applicable to TC produced by these manufacturers but it is not an endorsement of those products, nor a guarantee that they comply with the specifications. The specification may not be appropriate for TC produced by other manufacturers. The evaluation reports 571/2007 and 571/2009, as PART TWO, form an integral part of this publication.

1 Description

The material shall consist of azoxystrobin together with related manufacturing impurities, in the form of an off-white to light brown or yellowish powder and shall be free from visible extraneous matter and added modifying agents.

2 Active ingredient

2.1 Identity tests (CIPAC 571/TC/M/- Handbook M, p. 11, 2009)

The active ingredient shall comply with an identity test and, where the identity remains in doubt, shall comply with at least one additional test.

2.2 Azoxystrobin content (CIPAC 571/TC/M/- Handbook M, p. 11, 2009)

The azoxystrobin content shall be declared (not less than 965 g/kg) and, when determined, the average measured content shall not be lower than the declared minimum content.

* Specifications may be revised and/or additional evaluations may be undertaken. Ensure the use of current versions by checking at: http://www.fao.org/agriculture/crops/core-themes/theme/pests/pm/jmps/ps/en/
AZOXYSTROBIN WATER DISPERSIBLE GRANULES

FAO specification 571/WG (August 2009*)

This specification, which is PART ONE of this publication, is based on an evaluation of data submitted by the manufacturers whose names are listed in the evaluation reports (571/2007 and 571/2009). It should be applicable to relevant products of these manufacturers, and those of any other formulators who use only TC from the evaluated sources. The specification is not an endorsement of those products, nor a guarantee that they comply with the specification. The specification may not be appropriate for the products of other manufacturers who use TC from other sources. The evaluation reports 571/2007 and 571/2009, as PART TWO, form an integral part of this publication.

1 Description

The material shall consist of an homogeneous mixture of technical azoxystrobin, complying with the requirements of FAO specification 571/TC (August 2009), together with carriers and any other necessary formulants. It shall be in the form of cylindrical granules (approximate diameter 0.6–1 mm and length 2–8 mm), for application after disintegration and dispersion in water. The formulation shall be dry, free-flowing, essentially non-dusty, and free from visible extraneous matter and hard lumps.

2 Active ingredient

2.1 Identity tests (CIPAC 571/WG/M/- Handbook M, p. 14, 2009)

The active ingredient shall comply with an identity test and, where the identity remains in doubt, shall comply with at least one additional test.


The azoxystrobin content shall be declared (g/kg) and, when determined, the average content measured shall not differ from that declared by more than the following amounts:

<table>
<thead>
<tr>
<th>Declared content</th>
<th>Permitted tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Above 250 up to 500 g/kg</td>
<td>± 5% of the declared content</td>
</tr>
</tbody>
</table>

3 Physical properties


The formulation shall be completely wetted in 30 seconds, with swirling.

3.2 Wet sieve test (MT 185, CIPAC Handbook K, p.149, 2003)

Maximum: 0.5% retained on a 75 µm test sieve.


* Specifications may be revised and/or additional evaluations may be undertaken. Ensure the use of current versions by checking at:
Dispersibility: minimum 70% after 1 minute of stirring.

A minimum of 60% shall be in suspension after 30 minutes in CIPAC Standard Water D at 30 ± 2°C.

3.5 **Persistent foam** (MT 47.2, CIPAC Handbook F, p.152, 1995) (Note 3)
Maximum: 60 ml after 1 minute.

Essentially non-dusty.

3.7 **Flowability** (MT 172, CIPAC Handbook F, p.430, 1995)
At least 99% of the formulation shall pass through a 5 mm test sieve after 20 drops of the sieve.

Minimum: 90% attrition resistance.

4 **Storage stability**

4.1 **Stability at elevated temperature** (MT 46.3)
After storage at 54 ± 2°C for 14 days, the determined average active ingredient content must not be lower that 95% relative to the determined average content found before storage (Note 5) and the formulation shall continue to comply with the clauses for:
- wet sieve test (3.1)
- degree of dispersion (3.3)
- suspensibility (3.4)
- dustiness (3.6)
- attrition resistance (3.8)

---

**Note 1** The formulation should be tested at the highest and lowest rates of use recommended by the supplier, provided this does not exceed the conditions given in methods MT 168 and MT 184.

**Note 2** Chemical assay is the only fully reliable method to measure the mass of active ingredient still in suspension. However, the simpler gravimetric method, MT 168, may be used on a routine basis provided that it has been shown to give equal results to those of chemical assay. In case of dispute, chemical assay shall be the "referee method".

**Note 3** The mass of sample to be used in the test should be specified at the highest rate recommended by the supplier. The test is to be conducted in CIPAC standard water D.

**Note 4** Measurement of dustiness must be carried out on the sample "as received" and, where practicable, the sample should be taken from a newly opened container, because changes in the water content of samples may influence dustiness significantly. The optical method, MT 171.2, usually shows good correlation with the gravimetric method, MT 171.1, and can, therefore, be used as an alternative where the equipment is available. Where the correlation is in doubt, it must be checked with the formulation to be tested. In case of dispute the gravimetric method shall be used.

**Note 5** Analysis of the formulation, before and after the storage stability test, should be carried out concurrently (i.e. after storage) to reduce analytical error.
AZOXYSTROBIN AQUEOUS SUSPENSION CONCENTRATE

FAO specification 571/SC (August 2009*)

This specification, which is PART ONE of this publication, is based on an evaluation of data submitted by the manufacturers whose names are listed in the evaluation reports (571/2007 and 571/2009). It should be applicable to relevant products of these manufacturers, and those of any other formulators who use only TC from the evaluated sources. The specification is not an endorsement of those products, nor a guarantee that they comply with the specification. The specification may not be appropriate for the products of other manufacturers who use TC from other sources. The evaluation reports 571/2007 and 571/2009, as PART TWO, form an integral part of this publication.

1 Description

The material shall consist of a suspension of fine particles of technical azoxystrobin complying with the requirements of FAO specification 571/TC (August 2009), in an aqueous phase together with suitable formulants. After gentle agitation the material shall be homogeneous (Note 1) and suitable for further dilution in water.

2 Active ingredient

2.1 Identity tests (CIPAC 571/SC/M/-, CIPAC Handbook M, p. 15, 2009)

The active ingredient shall comply with an identity test and, where the identity remains in doubt, shall comply with at least one additional test.

2.2 Azoxystrobin content (CIPAC 571/SC/M/-, CIPAC Handbook M, p. 15, 2009)

The azoxystrobin content shall be declared (g/kg or g/l at 20 ± 2ºC, Note 3) and, when determined, the average content measured shall not differ from that declared by more than the following amounts:

<table>
<thead>
<tr>
<th>Declared content, g/kg or g/l at 20°C</th>
<th>Permitted tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Above 100 up to 250</td>
<td>± 6% of the declared content</td>
</tr>
</tbody>
</table>

3 Physical properties

3.1 pH range ((MT 75.3, CIPAC Handbook J, p.131, 2000)

pH range: 6 to 8.


Maximum residue: 8%.


A minimum of 80% of the azoxystrobin content found under 2.2 shall be in suspension after 5 minutes in CIPAC Standard Water D at 30 ± 2°C.

* Specifications may be revised and/or additional evaluations may be undertaken. Ensure the use of current versions by checking at: http://www.fao.org/agriculture/crops/core-themes/theme/pests/pm/jmps/ps/en/
3.4 **Suspensibility** (MT 184, CIPAC Handbook K, p.142, 2003) (Note 3)
A minimum of 90% of the azoxystrobin content found under 2.2 shall be in suspension after 30 minutes in CIPAC Standard Water D at 30 ± 2°C.

3.5 **Wet sieve test** (MT 185, CIPAC Handbook K, p.148, 2003) (Note 4)
Maximum: 0.1% of the formulation shall be retained on a 75 µm test sieve.

3.6 **Persistent foam** (MT 47.2, CIPAC Handbook F, p.152, 1995) (Note 5)
Maximum: 20 ml after 1 minute.

4 Storage stability

After storage at 0 ± 2°C for 7 days, the formulation shall continue to comply with clauses for:
- suspensibility (3.4),
- wet sieve test (3.5).

After storage at 54 ± 2°C for 14 days, the determined average active ingredient content must not be lower than 95% relative to the determined average content found before storage (Note 6) and the formulation shall continue to comply with the clauses for:
- pH range (3.1),
- pourability (3.2),
- spontaneity of dispersion (3.3),
- suspensibility (3.4),
- wet sieve test (3.5).

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**Note 1** Before sampling to verify the formulation quality, inspect the commercial container carefully. On standing, suspension concentrates usually develop a concentration gradient from the top to the bottom of the container. This may even result in the appearance of a clear liquid on the top and/or of sediment on the bottom. Therefore, before sampling, homogenize the formulation according to the instructions given by the manufacturer or, in the absence of such instructions, by gentle shaking of the commercial container (for example by inverting the closed container several times). Large containers must be opened and stirred adequately. After this procedure, the container should not contain a sticky layer of non-dispersed matter at the bottom. A suitable and simple method of checking for a non-dispersed sticky layer "cake" is by probing with a glass rod or similar device adapted to the size and shape of the container. All the physical and chemical tests must be carried out on a laboratory sample taken after the recommended homogenization procedure.

**Note 2** Unless homogenization is carried out carefully, it is possible for the sample to become aerated. This can lead to errors in the determination of the mass per millilitre and in calculation of the active ingredient content (in g/l) if methods other than MT 3.3 are used. If the buyer requires both g/kg and g/l at 20°C, then in case of dispute the analytical results shall be calculated as g/kg.

**Note 3** Chemical assay is the only fully reliable method to measure the mass of active ingredient still in suspension. However, simpler methods such as gravimetric and solvent extraction determination may be used on a routine basis provided that these methods have been shown
to give equal results to those of the chemical assay method. In case of dispute, the chemical method shall be the referee method.

**Note 4**  This test detects coarse particles (e.g. caused by crystal growth) or agglomerates (crust formation) or extraneous materials which could cause blockage of spray nozzles or filters in the spray tank.

**Note 5**  The mass of sample to be used in the test should correspond to the highest rate of use recommended by the supplier. The test is to be conducted in CIPAC standard water D.

**Note 6**  Samples of the formulation taken before and after the storage stability test should be analyzed concurrently after the test in order to reduce the analytical error.
AZOXYSTROBIN

2009 FAO/WHO evaluation report based on submission of information from Makhteshim (TC, WG, SC)

Supporting information
Annex 1: Hazard summary provided by the proposer
Annex 2: References

2007 FAO/WHO evaluation report based on submission of information from Syngenta (TC, WG, SC)

Supporting information
Annex 1: Hazard summary provided by the proposer
Annex 2: References
Recommendation

The Meeting recommended that

(i) the existing FAO specifications for azoxystrobin TC, WG and SC should be extended to encompass the products of Makhteshim Chemical Works

Appraisal

Data provided by Makhteshim Chemical for azoxystrobin in 2008 were evaluated in support of an equivalence determination with the existing FAO specifications. Makhteshim azoxystrobin suspension concentrate is currently registered in the United Kingdom.

The confidential data provided on the manufacturing process and batch analyses of azoxystrobin are identical to those submitted for registration in UK.

As some differences in the proposed specifications for azoxystrobin TC, WG and SC became evident which were not expected to adversely affect hazard, the existing FAO specifications had to be extended to encompass the material of Makhteshim. This holds for the specifications as follows:

**TC:** The Makhteshim TC is described as "...a yellowish powder..." whereas the reference is an off-white powder. The description was modified to include the yellowish powder as "...an off-white to light brown powder ...".

The declared minimum active ingredient content (965 g/kg) agrees with that of the FAO specification.

**WG:** For the WG, data were available on: flowability, pH, wettability, persistent foam, dispersibility, suspensibility, wet sieve, dustiness, attrition resistance and accelerated storage testing (54 °C). The WG formulation generally complied with all specification clauses except the pH range with measured values of 9.7 before and after storage (specification pH range 5 to 7.5).

Azoxystrobin was reported as stable to hydrolysis (<10 % loss) at pH 5, 7 and 9 and 25 °C when tested for 31 days. Its half-life (DT\(_{50}\)) was estimated at 12 days and 2 hours at pH 9 and 50 °C (Germany, 1997). The content of active ingredient in a WG of pH 9.7 complied with the specification in the elevated temperature storage stability test, demonstrating stability in a WG at pH 9.7. Makhteshim provided information that the measured pH of two other WG batches was 8.4. Furthermore, the calcium carbonate filler material was responsible for the alkaline pH.
The 2007 JMPS had questioned the requirement for control of pH. “The manufacturer explained that product stability was known to be acceptable within the proposed pH ranges, whereas certain formulants may be adversely affected at more extreme pH values and the active ingredient is more stable at pH below 9.” The 2007 Meeting therefore accepted the proposed limits.

The additional evidence now suggests that a pH specification is not necessary for quality control. The Meeting agreed to delete the pH range specification for azoxystrobin WG formulations and to amend the WG specifications accordingly.

SC: Data were available on the following clauses: pH, spontaneity of dispersion, suspensibility, wet sieve, pourability, persistent foam, accelerated storage testing (54 °C) and storage stability at 0 °C. The SC formulations generally complied with all specifications except pourability with measured values of 7.5-8.0 % (specification 5 %).

The Meeting agreed that 8 % is an acceptable value for pourability and that the specification could be increased to 8 % to include this product.

Manufacturing limits for impurities identified in the technical material did not exceed the limits in the reference profile. No new impurities were identified. Mass balances were in the range of 99.3-99.8 %. It should be noted that at the time of data submission this material was not in commercial production and the manufacturing limits had been calculated from the results of the 5-batch analyses.

The analytical method for the active ingredient, azoxystrobin, was reversed-phase HPLC with UV detection. HPLC-UV, and others also determined some impurities by GC-MSD. Validation data were provided for azoxystrobin and the impurities. Methods for the impurities were validated to LOQs of 0.5 g/kg in the TC.

Toxicity data were available for rat acute oral, rat acute dermal, rat acute inhalation, rabbit eye irritation, rabbit skin irritation and guinea-pig skin sensitization. The ratings were equivalent to those of the reference material.

The Meeting concluded that the Makhteshim azoxystrobin TC was equivalent to the azoxystrobin reference TC.

The physical and chemical properties of pure and technical grade active ingredient were essentially the same as those for the reference material for melting point, water solubility and log P<sub>ow</sub>.

The vapour pressures at 20 °C were substantially different: 1.1×10<sup>-10</sup> Pa for the reference material and 6.3 x 10<sup>-9</sup> Pa for the pure material from Makhteshim. For the reference material, measurements were made on the solid at elevated temperatures and for the Makhteshim material, measurements were made on the liquid at elevated temperatures. In both cases the elevated temperature values were extrapolated to 20 °C values. Most likely the difference is because the reference material vapour pressure is for solid and the Makhteshim material is for theoretical liquid at 20 °C.
SUPPORTING INFORMATION
FOR
EVALUATION REPORT 571/2009
Physico-chemical properties of azoxystrobin

Table 1. Physical and chemical properties of pure and technical grade azoxystrobin.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value(s) and conditions</th>
<th>Purity %</th>
<th>Method reference</th>
<th>Study ref</th>
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<tr>
<td>Pure azoxystrobin</td>
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<td></td>
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<tr>
<td>Vapour pressure</td>
<td>$6.3 \times 10^{-9}$ Pa at 20 °C (extrapolated from liquid phase</td>
<td>99.2 %</td>
<td>OECD 104, effusion.</td>
<td>R-24107</td>
</tr>
<tr>
<td></td>
<td>measurements at 116.9 to 151.3 °C). Note¹</td>
<td></td>
<td>Measurements from</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>103.1 to 151.3 °C)</td>
<td></td>
</tr>
<tr>
<td>Temperature of decomposition</td>
<td>265 °C by differential thermal calorimetric scanning (nitrogen</td>
<td>99.2 %</td>
<td>OECD 113</td>
<td>R-24107</td>
</tr>
<tr>
<td></td>
<td>atmosphere)</td>
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<td>Technical grade material</td>
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<td>Melting point</td>
<td>115.9 °C</td>
<td>97.2 %</td>
<td>OECD 102</td>
<td>PE DEPDA</td>
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<tr>
<td>Solubility in water</td>
<td>$5.6 \pm 0.2$ mg/l at 20 °C at pH 5.91. No pH dependency can be</td>
<td>96.9 %</td>
<td>OECD 105</td>
<td>R-24107</td>
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<tr>
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<td>expected from structural formula</td>
<td></td>
<td></td>
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<tr>
<td>Solubility in acetone</td>
<td>$94.3 \pm 0.79$ g/l at 20 °C</td>
<td>96.9 %</td>
<td>based on</td>
<td>R-24107</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>OECD 105</td>
<td></td>
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<tr>
<td>Solubility in methanol</td>
<td>$22.7 \pm 0.46$ g/l at 20 °C</td>
<td>96.9 %</td>
<td>based on</td>
<td>R-24107</td>
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<td>Octanol-water partition coefficient</td>
<td>$\log P_{OW} = 2.71$ at 20 °C at pH 5.03. No pH dependency can be</td>
<td>96.9 %</td>
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<td>Dissociation characteristics</td>
<td>does not dissociate</td>
<td>no data</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note¹ Vapour pressure measurements were made over the temperature range 103.1 to 151.3 °C with 2 measurements on the solid (103.1 and 109.0 °C) and 10 on the liquid (116.9 to 151.3 °C). Extrapolation beyond the range of measurement relies on the Clapeyron-Clausius equation.

$$\ln(p) = \frac{\Delta H_v}{RT} + \text{const}$$

$p$: vapour pressure
$\Delta H_v$: heat of vaporization
$R$: gas constant
$T$: absolute temperature

The extrapolation is valid only over the temperature range where $\Delta H_v$ is constant and it is not constant through a liquid-solid phase change.

If the vapour pressure measurements for the liquid phase are extrapolated to 20 °C, the extrapolated value at 20 °C represents a theoretical vapour pressure for liquid phase at 20 °C.

It should be noted that the vapour pressure recorded for azoxystrobin in the 2007 JMPS Evaluation ($1.1 \times 10^{-10}$ Pa at 20 °C) was based on an extrapolation from measurements on azoxystrobin all
below its melting point, i.e. an extrapolation from vapour pressure measurements on solid phase.

Table 2. Chemical composition and properties of azoxystrobin technical materials (TC)

<table>
<thead>
<tr>
<th>Manufacturing process, maximum limits for impurities ≥ 1 g/kg, 5 batch analysis data</th>
<th>Confidential information supplied and held on file by FAO. Mass balances were 99.3-99.8 %. Percentages of unknowns were 0.3-0.7 %.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Declared minimum active ingredient content</td>
<td>965 g/kg</td>
</tr>
<tr>
<td>Relevant impurities ≥ 1 g/kg and maximum limits for them</td>
<td>None</td>
</tr>
<tr>
<td>Relevant impurities &lt; 1 g/kg and maximum limits for them:</td>
<td>None</td>
</tr>
<tr>
<td>Stabilisers or other additives and maximum limits for them:</td>
<td>None</td>
</tr>
<tr>
<td>Melting temperature range of the TC</td>
<td>115.9 °C</td>
</tr>
</tbody>
</table>

**Formulations**

The main formulation type available for Makhteshim azoxystrobin is the SC. Azoxystrobin may be co-formulated with other active ingredients. Makhteshim formulations are currently registered and sold e.g. in the United Kingdom.

**Physical properties of azoxystrobin formulations**

The physical properties, the methods for testing them and the limits proposed for the SC and WG formulations, comply with the requirements of the FAO Manual (FAO, 2006).

**Methods of analysis and testing**

Test methods for determination of physico-chemical properties of the technical active ingredient were OECD, EPA, EC, while those for the formulations were CIPAC as indicated in the specifications.

**Containers and packaging**

No special requirements for containers and packaging have been identified.

**Expression of the active ingredient**

The active ingredient is expressed as azoxystrobin.
ANNEX 1

HAZARD SUMMARY PROVIDED BY THE PROPOSER

Note: Makhteshim provided written confirmation that the toxicological data included in the following summary were derived from azoxystrobin having impurity profiles similar to those referred to in Table 2, above.
Table A. Toxicology profile of the azoxystrobin technical material, based on acute toxicity, irritation and sensitization

<table>
<thead>
<tr>
<th>Species</th>
<th>Test</th>
<th>Duration and conditions or guideline adopted</th>
<th>Result</th>
<th>Study ref</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat (f)</td>
<td>oral OECD 423, 6 animals.</td>
<td>Single dose 2000 mg/kg bw administered in corn oil purity 96.9 % w/w, observed for 14 days.</td>
<td>LD$_{50}$ &gt; 2000 mg/kg bw no adverse effects</td>
<td>RF-0023.305.401.06</td>
</tr>
<tr>
<td>Rat, (m,f)</td>
<td>dermal OECD 402, 10 animals.</td>
<td>Single dose 2000 mg/kg bw administered in corn oil, 24-hours skin contact exposure purity 96.9 % w/w, observed for 14 days.</td>
<td>LD$_{50}$ &gt; 2000 mg/kg bw no adverse effects</td>
<td>RF-0023.310.381.06</td>
</tr>
<tr>
<td>Rat, (m,f)</td>
<td>inhalation OECD 403, 10 animals (5M+5F) per dose. powder aerosol 0.18, 0.38, 0.93 mg/l air, 4-hours nose only exposure. Purity 98.4 % w/w. Observed for 14 days after exposure.</td>
<td></td>
<td>LC50 ~ 0.38 mg/l air R-24802</td>
<td></td>
</tr>
<tr>
<td>Rabbit (m)</td>
<td>skin irritation OECD 404, 3 animals.</td>
<td>Single dose 0.5 g/kg bw 4 h dermal exposure, purity 96.9% w/w, observed for 72 hours.</td>
<td>Not irritating</td>
<td>RF-0023.311.401.06</td>
</tr>
<tr>
<td>Rabbit (m,f)</td>
<td>eye irritation OECD 405, 3 animals.</td>
<td>Single instillation of 100 mg in one eye purity 96.9% w/w. observed for 7 days.</td>
<td>Not irritating</td>
<td>RF-0023.312.499.06</td>
</tr>
<tr>
<td>Guinea pig (m)</td>
<td>skin sensitisation</td>
<td>OECD 406, 20 animals applied undiluted 0.5 g/animal for both induction and challenge purity 96.9% w/w.</td>
<td>Not sensitizing</td>
<td>RF-0023.318.358.06</td>
</tr>
</tbody>
</table>

Technical azoxystrobin is of low acute toxicity upon oral or dermal administration and of moderate toxicity by the inhalation route. It is a slight skin and eye irritant. According to EU guidelines, classification and labelling as a skin or eye irritant are not required. The compound is not a skin sensitizer.

Classification of azoxystrobin based on GHS conclusions for toxicity would be (O'Brien, 2009):

- Category: 4.
- GHS pictogram: diamond with exclamation mark.
- Signal word: Warning.
- Hazard sentences: H332 Harmful if inhaled.
- Precautionary sentences: P304 + P340, P312.
CHRONIC TOXICITY
No information was available on subacute to chronic toxicity of the azoxystrobin technical material.

MUTAGENICITY
No information was available on the mutagenicity profile of the azoxystrobin technical material.

ECOTOXICITY
No information was available on ecotoxicity of the azoxystrobin technical material.
## REFERENCES

(SORTED BY REPORT OR STUDY NUMBER)

<table>
<thead>
<tr>
<th>Source</th>
<th>Year</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>FAO</td>
<td>2008</td>
<td>FAO specifications and evaluations for azoxystrobin.</td>
</tr>
<tr>
<td>Dobrat W</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dobrat W</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


RF-0023.305.401.06 2007  Acute oral toxicity study with MIL S 130/05 in rats. BIOAGRI Laboratorios, Brazil. GLP. Report RF-0023.305.401.06. Unpublished.

RF-0023.310.381.06 2006  Acute dermal toxicity study with MIL S 130/05 in rats. BIOAGRI Laboratorios, Brazil. GLP. Report RF-0023.310.381.06. Unpublished.

RF-0023.311.401.06 2006  Acute dermal irritation/corrosion study in rabbits with MIL S 130/05. BIOAGRI Laboratorios, Brazil. GLP. Report RF-0023.311.401.06. Unpublished.

RF-0023.312.499.06 2006  Acute eye irritation/corrosion study in rabbits with MIL S 130/05. BIOAGRI Laboratorios, Brazil. GLP. Report RF-0023.312.499.06. Unpublished.

RF-0023.318.358.06 2006  Skin sensitisation test of MIL S 130/05 in guinea pigs (Cavia porcellus). (Buehler test method). BIOAGRI Laboratorios, Brazil. GLP. Report RF-0023.318.358.06. Unpublished.

AZOXYSTROBIN
FAO/WHO EVALUATION REPORT 571/2007

Recommendation

The Meeting recommended that the specifications for azoxystrobin TC, WG and SC, proposed by Syngenta Crop Protection AG, should be adopted by FAO.

Appraisal

Data provided by Syngenta Crop Protection AG for azoxystrobin in 2006 were evaluated in support of proposed new FAO specifications for TC, SC and WG.

Azoxystrobin has not been evaluated by the FAO/WHO JMPR or IPCS, but has been reviewed by the US EPA and the EU.

Azoxystrobin is under patent in most countries until 2010.

Azoxystrobin is a solid, melting at 116°C. Its water solubility is about 6 mg/l and is not pH dependent. It is very soluble in certain organic solvents but its octanol-water partition coefficient (log P_{OW} = 2.5) does not indicate fat solubility. It has a low vapour pressure and Henry's constant, therefore significant volatilization is not expected. Azoxystrobin is stable at pH 4-9 and it is degraded only slowly by photolysis.

The Meeting was provided with details of the manufacturing process, 5 batch analysis data (production from March to December 2005), and manufacturing limits for azoxystrobin content and impurities present at or above 1 g/kg. Mass balances were high (98.7-99.6%), no unknowns (≥1 g/kg) were detected and the minimum active ingredient in technical material was 965 g/kg. The current manufacturing process produces a higher purity than previously and no new impurities have been found. The data were confirmed as being essentially similar to those submitted for registration in the UK, with the exception of an increase in the minimum azoxystrobin content from 930 g/kg to 965 g/kg in the current manufacturing specification.

The Meeting agreed that none of the impurities should be considered relevant.

Analytical methods for the determination of azoxystrobin and impurities were based on gas chromatography. The method for determination of azoxystrobin in TC, WG and SC was adopted by CIPAC in 2007, with provisional status.

The proposed specifications were broadly in accordance with the requirements of the manual (FAO/WHO 2006) but the following issues were addressed by the Meeting.

WG and SC. The Meeting questioned the requirement for control of pH. The manufacturer explained that product stability was known to be acceptable within the proposed pH ranges, whereas certain formulants may be adversely affected at more extreme pH values and the active ingredient is more stable at pH <9. The Meeting therefore accepted the proposed limits.

WG. The Meeting questioned the proposed limits of 60% for suspensibility and 60 ml of persistent foam, as both represented the maximum normally accepted. The manufacturer explained that the dispersed particles are relatively large and the
surfactants required for the product mean that neither limit can be changed. Based on experience of selling the product over a number of years, the manufacturer stated that these properties have not caused any problems in use. The Meeting therefore accepted the proposed limits. The Meeting considered a proposed limit of 80% attrition resistance to be low for an extruded WG. After reconsideration of the supporting data, the manufacturer stated that it would be possible to comply with a limit of 90% and this was agreed by the Meeting.

SC. The manufacturer proposed a non-standard pourability sub-clause for “rinsed residue” but agreed with the Meeting that this characteristic should not be specified. The manufacturer also proposed non-standard clauses for viscosity and particle size distribution but agreed with the Meeting that, although these characteristics may be important for manufacturing purposes, they should not form part of the FAO specification.
Uses

Azoxystrobin is a systemic fungicide, its activity resulting from inhibition of electron transfer between cytochrome b and cytochrome c in fungal mitochondria. It is used for the control of a wide variety of fungal diseases in agriculture/horticulture and viticulture.

Identity of the active ingredient

ISO common name: Azoxystrobin (E-ISO, BSI)

Chemical name(s):
- IUPAC, methyl (E)-2-\{2-\{6-(2-cyanophenoxy)pyrimidin-4-yloxy\}phenyl\}-3-methoxyacrylate
- CA, methyl (E)-2-\{\{6-(2-cyanophenoxy)-4-pyrimidinyl\}oxy\}-\alpha-\((\text{methoxymethylene})\) benzeneacetate (9CI)

Synonyms: none

Structural formula:

![Structural formula of Azoxystrobin](image)

Molecular formula: $C_{22}H_{17}N_3O_5$

Relative molecular mass: 403.4

CAS Registry number: 131860-33-8

CIPAC number: 571

Identity tests: GC retention time; IR spectrum
Physico-chemical properties of azoxystrobin

Table 1. Physico-chemical properties of pure azoxystrobin

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value(s) and conditions</th>
<th>Purity %</th>
<th>Method</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vapour pressure</td>
<td>1.1 x 10^{-10} Pa at 20°C</td>
<td>99.0</td>
<td>OECD 104, by extrapolation</td>
<td>ICI5504/0028</td>
</tr>
<tr>
<td>Melting point</td>
<td>116°C</td>
<td>99.0</td>
<td>OECD 102</td>
<td>ICI5504/0028</td>
</tr>
<tr>
<td>Boiling point, temperature of decomposition</td>
<td>Boiling point: cannot be determined at atmospheric pressure Decomposition temperature: ~345°C</td>
<td>99.0</td>
<td>OECD 113</td>
<td>ICI5504/0039</td>
</tr>
<tr>
<td>Solubility in water at 20°C</td>
<td>6.0 mg/l at 20°C in purified water, approximately neutral pH</td>
<td>99.0</td>
<td>EPA Guideline CG-1510</td>
<td>ICI5504/0028</td>
</tr>
<tr>
<td>Partition coefficient log P_{OW}</td>
<td>log P_{OW} = 2.5 at 20°C at pH 7</td>
<td>99.0</td>
<td>OECD 107</td>
<td>ICI5504/0028</td>
</tr>
<tr>
<td>Hydrolysis characteristics</td>
<td>Half-life = 12 days at 50°C at pH 9 No significant hydrolysis (&lt;10%) after 31 days at 25°C nor after a further 12 days at 50°C at pH 5 and 7.</td>
<td>&gt;98</td>
<td>EPA Guideline 161-1</td>
<td>ICI5504/0824</td>
</tr>
<tr>
<td>Photolysis characteristics</td>
<td>Continuous irradiation at 25°C and pH 7 gave an estimated reaction half-life of 8.7 to 13.9 days Florida summer sunlight. At least 15 photo-degradation products were observed but only one, azoxystrobin Z-isomer, was present at &gt;10%.</td>
<td>&gt;98</td>
<td>EPA Guideline 161-2</td>
<td>ICI5504/0823</td>
</tr>
<tr>
<td>Dissociation characteristics</td>
<td>Does not dissociate</td>
<td>99.0</td>
<td>OECD 112</td>
<td>ICI5504/0028</td>
</tr>
</tbody>
</table>

Table 2. Chemical composition and properties of technical azoxystrobin (TC)

<table>
<thead>
<tr>
<th>Manufacturing process, maximum limits for impurities ≥ 1 g/kg, 5 batch analysis data</th>
<th>Confidential information supplied and held on file by FAO. Mass balances were 98.7-99.6%, with no unknowns ≥1 g/kg.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Declared minimum azoxystrobin content</td>
<td>965 g/kg</td>
</tr>
<tr>
<td>Relevant impurities ≥ 1 g/kg and maximum limits for them</td>
<td>None</td>
</tr>
<tr>
<td>Relevant impurities &lt; 1 g/kg and maximum limits for them</td>
<td>None</td>
</tr>
<tr>
<td>Stabilizers or other additives and maximum limits for them</td>
<td>None</td>
</tr>
<tr>
<td>Melting temperature range of the TC</td>
<td>114-116°C</td>
</tr>
</tbody>
</table>

Hazard summary

Azoxystrobin has not been evaluated by the FAO/WHO JMPR or IPCS, but has been reviewed by the US EPA and the EU.
EU hazard classifications are: (i) R 23 toxic by inhalation (T, toxic); (ii) R 50/53 very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment (N, dangerous for the environment).

The US EPA Signal Word for technical azoxystrobin is: Caution. US EPA has concluded that azoxystrobin in not likely to cause cancer and is not a developmental or reproduction toxicant. However, azoxystrobin can persist for several months or longer and some of its degradation products have properties similar to chemicals which are known to leach through soil to ground water under certain conditions as a result of agricultural use. Thus US EPA concluded that use of azoxystrobin in areas where soils are permeable, particularly where the water table is shallow, may result in ground water contamination. US EPA noted that azoxystrobin is toxic to freshwater and estuarine/marine fish and aquatic invertebrates and issued instructions that it should be kept out of lakes, streams, ponds, tidal marshes, or estuaries.

The WHO hazard classification of azoxystrobin is “U, unlikely to present acute hazard in normal use” (WHO 2002).

Formulations

The main formulation types available are SC and WG and azoxystrobin may be co-formulated with other fungicides. These formulations are registered and sold in many countries worldwide.

Methods of analysis and testing

Azoxystrobin is determined by capillary GC with FID and internal standardization with 3-(2-pyridyl)-5,6-diphenyl-1,2,4-triazine. An additional identity test is based on the IR spectrum. The method was adopted by CIPAC, with provisional status, in 2007, following a successful collaborative study. The GC method gives a good resolution between azoxystrobin (E-isomer) and the Z-isomer.

Impurities were determined by GC.

Test methods for determination of physico-chemical properties of the technical active ingredient were OECD and EPA, while those for the formulations were CIPAC, as indicated in the specifications.

Physical properties

The physical properties, the methods for testing them and the limits proposed for the SC and WG formulations, comply with the requirements of the manual (FAO/WHO 2006).

Containers and packaging

No special requirements for containers and packaging have been identified.

Expression of the active ingredient

The active ingredient is expressed as azoxystrobin.
ANNEX 1
HAZARD SUMMARY PROVIDED BY THE PROPOSER

Note: the proposer provided written confirmation that the toxicological data included in the following summary were derived from azoxystrobin having impurity profiles similar to those referred to in Table 2, above.
### Table A. Toxicology profile of azoxystrobin technical material, based on acute toxicity, irritation and sensitization

<table>
<thead>
<tr>
<th>Species</th>
<th>Test</th>
<th>Duration and conditions</th>
<th>Result</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat (m,f)</td>
<td>Oral</td>
<td>Administered in corn oil, observed up to 15 days, OECD 401 (purity 95.2% w/w), single dose 5000 mg/kg bw</td>
<td>MLD &gt;5000 mg/kg bw</td>
<td>ICI5504/0081</td>
</tr>
<tr>
<td>Mouse (m,f)</td>
<td>Oral</td>
<td>Administered in corn oil, observed up to 15 days, OECD 401 (purity 95.2% w/w), single dose 5000 mg/kg bw</td>
<td>MLD &gt;5000 mg/kg bw</td>
<td>ICI5504/0084</td>
</tr>
<tr>
<td>Rat (m,f)</td>
<td>Dermal</td>
<td>Dermal application for 24 h, observed up to 15 days, OECD 402 (purity 95.2% w/w), single dose 2000 mg/kg bw</td>
<td>LD₅₀ &gt;2000 mg/kg bw</td>
<td>ICI5504/0085</td>
</tr>
<tr>
<td>Rat (m,f)</td>
<td>Inhalation</td>
<td>4 h exposure nose-only, OECD 403 (purity 96.2% w/w), doses up to 968 μg/l (atmospheric concentration)</td>
<td>LC₅₀ = 698 mg/m³ (f) = 962 mg/m³ (m)</td>
<td>ICI5504/0087</td>
</tr>
<tr>
<td>Rabbit (f)</td>
<td>Skin irritation</td>
<td>4 h dermal exposure, observed up to 7 d, OECD 404 (purity 95.2% w/w), single dose 500 mg/kg bw</td>
<td>Non-irritant (based on EU legislation)</td>
<td>ICI5504/0082</td>
</tr>
<tr>
<td>Rabbit (f)</td>
<td>Eye irritation</td>
<td>Single instillation of 100 mg, OECD 405 (purity 95.2% w/w)</td>
<td>Non-irritant (based on EU legislation)</td>
<td>ICI5504/0083</td>
</tr>
<tr>
<td>Guinea pig</td>
<td>Skin sensitization</td>
<td>Magnusson &amp; Kligman OECD 406 (purity 95.2% w/w), doses of 30 and 67% w/v.</td>
<td>Non-sensitizer</td>
<td>ICI5504/1259</td>
</tr>
<tr>
<td>Rat</td>
<td>Acute neurotoxicity</td>
<td>Draft OECD 424 (purity 96.2% w/w), single dose 2000 mg/kg bw</td>
<td>No neurotoxicity</td>
<td>ICI5504/0161</td>
</tr>
</tbody>
</table>

Azoxystrobin is very poorly absorbed through the skin. Moderate inhalation toxicity was observed with particulates having a highly inhalable size distribution. Azoxystrobin is a slight irritant to rabbit skin and a slight irritant to rabbit eyes but, for both end-points, the observations were insufficient to trigger EU hazard classification.

### Table B. Toxicology profile of azoxystrobin technical material, based on repeated administration (sub-acute to chronic)

<table>
<thead>
<tr>
<th>Species</th>
<th>Test</th>
<th>Duration and conditions</th>
<th>Result</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat (m,f)</td>
<td>Oral</td>
<td>90 d, OECD 408 (purity 95.2% w/w), doses up to 6000 ppm</td>
<td>NOAEL = 20 mg/kg bw/d, LOEL = 20 mg/kg bw/d</td>
<td>ICI5504/0099</td>
</tr>
<tr>
<td>Dog (m,f)</td>
<td>Oral</td>
<td>90 d, OECD 409 (purity 96.2% w/w), doses up to 250 mg/kg bw/d</td>
<td>NOAEL = 10 mg/kg bw/d</td>
<td>ICI5504/0101</td>
</tr>
<tr>
<td>Rat (m,f)</td>
<td>Dermal</td>
<td>21 d, OECD 410 (purity 96.2% w/w), doses up to 1000 mg/kg bw</td>
<td>NOEL = 1000 mg/kg bw/d (limit dose)</td>
<td>ICI5504/0089</td>
</tr>
<tr>
<td>Rat (m,f)</td>
<td>feeding, carcinogenicity</td>
<td>2 years, OECD 453 (purity 96.2% w/w), doses up to 1500 ppm</td>
<td>No carcinogenicity NOAEL = 18 mg/kg bw/d, LOEL = 18 mg/kg bw/d</td>
<td>ICI5504/0110</td>
</tr>
</tbody>
</table>
Table B. Toxicology profile of azoxystrobin technical material, based on repeated administration (sub-acute to chronic)

<table>
<thead>
<tr>
<th>Species (m,f)</th>
<th>Test</th>
<th>Duration and conditions</th>
<th>Result</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dog feeding, carcinogenicity</td>
<td>1 year, OECD 452 (purity 96.2% w/w), doses up to 200 mg/kg bw/d</td>
<td>No carcinogenicity NOEL = 3 mg/kg bw/d NOAEL = 200 mg/kg bw/d</td>
<td>ICI5504/0106</td>
<td></td>
</tr>
<tr>
<td>Mouse (m,f)</td>
<td>carcinogenicity</td>
<td>2 years, OECD 451 (purity 96.2% w/w), doses up to 2000 ppm</td>
<td>No carcinogenicity</td>
<td>ICI5504/0108</td>
</tr>
<tr>
<td>Rat (m,f) Generation reproduction</td>
<td>2-generation, OECD 416 (purity 96.2% w/w), doses up to 1500 ppm (170 mg/kg bw/d)</td>
<td>NOAEL = 32 mg/kg bw/d (general toxicity) NOAEL = 170 mg/kg bw/d (reproductive toxicity)</td>
<td>ICI5504/0117</td>
<td></td>
</tr>
<tr>
<td>Rat (m,f)</td>
<td>sub-chronic neurotoxicity</td>
<td>Draft OECD 424 (purity 96.2% w/w), doses up to 2000 ppm</td>
<td>No neurotoxicity up to highest dose of ~100 mg/kg/d</td>
<td>ICI5504/0163</td>
</tr>
<tr>
<td>Rabbit Developmental toxicity</td>
<td>OECD 414 (purity 96.2% w/w), doses up to 50 mg/kg bw/d</td>
<td>NOEL/NOAEL = 20 mg/kg bw (developmental) NOEL/NOAEL = 7.5 mg/kg bw (maternal toxicity)</td>
<td>ICI5504/0122</td>
<td></td>
</tr>
<tr>
<td>Rabbit Developmental toxicity</td>
<td>OECD 414 (purity 96.2% w/w), doses up to 500 mg/kg bw/d</td>
<td>NOEL &gt;500 mg/kg bw/d (developmental) NOAEL = 50 mg/kg bw/d (maternal) Not teratogenic</td>
<td>ICI5504/0122</td>
<td></td>
</tr>
<tr>
<td>Rat Developmental toxicity</td>
<td>OECD 414 (purity 95.2% w/w), doses up to 300 mg/kg bw/d</td>
<td>NOAEL = 25 mg/kg (maternal and developmental) Not teratogenic</td>
<td>ICI5504/0112</td>
<td></td>
</tr>
</tbody>
</table>

Azoxystrobin at doses up to the maximum tolerated in rat and mouse provided no evidence for carcinogenicity.

In the first rabbit developmental toxicity study, azoxystrobin appeared to cause developmental toxicity at a dose level of 50 mg/kg/day in presence of maternal toxicity. However, a series of investigative studies (reported in ICI5504/0122) conclusively demonstrated that the effects seen in the first study were caused by the dose vehicle. In the second definitive rabbit developmental toxicity study, maternal toxicity occurred at ≥150 mg/kg bw/d but there was no effect on foetal development up to the highest dose. In the rat developmental toxicity study, development effects were seen only at maternally toxic doses (100 mg/kg bw/d). A two-generation reproduction study in the rat showed no evidence of reproductive toxicity, even at doses where maternal toxicity was evident. No evidence for neurotoxicity was observed in any study.
Table C. Mutagenicity profile of azoxystrobin technical material, based on *in vitro* and *in vivo* tests

<table>
<thead>
<tr>
<th>Species</th>
<th>Test</th>
<th>Duration and conditions</th>
<th>Result</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Salmonella typhimurium</em> TA1535, TA1537, TA98, TA100; <em>Escherichia coli</em> WP2P, WP2P uvrA</td>
<td>Bacterial mutation assay; <em>in vitro</em></td>
<td>OECD guidelines 471 and 472 (purity 97.2% w/w), doses up to 5000 µg/plate</td>
<td>Negative</td>
<td>ICI5504/0140</td>
</tr>
<tr>
<td>L5178Y TK&lt;sup&gt;+&lt;/sup&gt;-/- mouse lymphoma cells</td>
<td>Mammalian cell gene mutation assay, <em>in vitro</em></td>
<td>OECD 476 (purity 96.2% w/w), doses up to 80 µg/ml</td>
<td>Positive</td>
<td>ICI5504/0143</td>
</tr>
<tr>
<td>Human lymphocytes (chromosomal aberrations)</td>
<td>Mammalian cell cytogenetic assay, <em>in vitro</em></td>
<td>OECD guidelines 473 (purity 95.2% w/w), doses up to 1500 µg/ml</td>
<td>Positive</td>
<td>ICI5504/0131</td>
</tr>
<tr>
<td>Mouse bone marrow (m,f)</td>
<td>Mouse bone marrow micronucleus assay, <em>in vivo</em></td>
<td>OECD 474 (purity 97.2% w/w), single dose 5000 mg/kg bw</td>
<td>Negative</td>
<td>ICI5504/0133</td>
</tr>
<tr>
<td>Rat hepatocytes (m)</td>
<td>Rat liver unscheduled DNA synthesis assay, <em>in vivo</em></td>
<td>Draft OECD 486 (purity 97.2% w/w), doses up to 2000 mg/kg bw</td>
<td>Negative</td>
<td>ICI5504/0136</td>
</tr>
</tbody>
</table>

Azoxystrobin was negative in most genotoxicity tests but induced TK mutations in mouse lymphoma cells *in vitro* and there was evidence of a concentration-dependent clastogenic activity in human lymphocytes *in vitro* in the presence of moderate to severe cytotoxicity.

Table D. Ecotoxicology profile of azoxystrobin technical material

<table>
<thead>
<tr>
<th>Species</th>
<th>Test</th>
<th>Duration and conditions</th>
<th>Result</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mallard duck (<em>Anas platyrhynchos</em>)</td>
<td>Acute oral toxicity</td>
<td>5 m 5 f, single dose of 0, 250, 400, 1000 or 2000 mg/kg bw (purity 96.2% w/w)</td>
<td>LD&lt;sub&gt;50&lt;/sub&gt; &gt;2000 mg/kg</td>
<td>ICI5504/0851</td>
</tr>
<tr>
<td>Bobwhite quail (<em>Colinus virginianus</em>)</td>
<td>Acute oral toxicity</td>
<td>5 m 5 f, single dose of 0, 250, 400, 1000 or 2000 mg/kg bw (purity 96.2% w/w)</td>
<td>LD&lt;sub&gt;50&lt;/sub&gt; &gt;2000 mg/kg</td>
<td>ICI5504/0852</td>
</tr>
<tr>
<td>Mallard duck</td>
<td>Short-term dietary toxicity</td>
<td>10 ducks, diet with 163, 325, 650, 1300, 2600 or 5200 ppm for 5 days (purity 96.2% w/w)</td>
<td>LC&lt;sub&gt;50&lt;/sub&gt; &gt;5200 mg/kg diet</td>
<td>ICI5504/0853</td>
</tr>
<tr>
<td>Bobwhite quail</td>
<td>Short-term dietary toxicity</td>
<td>10 ducks, diet with 163, 325, 650, 1300, 2600 or 5200 ppm for 5 days (purity 96.2% w/w)</td>
<td>LC&lt;sub&gt;50&lt;/sub&gt; &gt;5200 mg/kg diet</td>
<td>ICI5504/1272</td>
</tr>
<tr>
<td>Mallard duck</td>
<td>Sub-chronic toxicity and reproduction</td>
<td>6 replicates, 2 m 5 f, diet with 0, 500, 1200 or 3000 ppm, 23 weeks (purity 96.2% w/w)</td>
<td>NOEC = 1200 mg/kg diet</td>
<td>ICI5504/0856</td>
</tr>
<tr>
<td><em>Colinus virginianus</em> northern bobwhite quail</td>
<td>Sub-chronic toxicity and reproduction</td>
<td>20 replicates, 1 m 1 f adults, diet with 0, 500, 1200 or 3000 ppm, 22 weeks (purity 96.2% w/w)</td>
<td>NOEC = 1200 mg/kg diet</td>
<td>ICI5504/0857</td>
</tr>
<tr>
<td><em>Onchorhynchus mykiss</em> rainbow trout</td>
<td>Acute toxicity</td>
<td>96 h exposure to 32, 56, 100, 180, 320 or 560 µg/l, flow-through system (purity 96.2% w/w)</td>
<td>LC&lt;sub&gt;50&lt;/sub&gt; = 0.47 mg/l</td>
<td>ICI5504/0909</td>
</tr>
<tr>
<td>Species</td>
<td>Test</td>
<td>Duration and conditions</td>
<td>Result</td>
<td>Reference</td>
</tr>
<tr>
<td>---------------------------------</td>
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</tr>
<tr>
<td>Fathead minnow Pimephales promelas</td>
<td>Extended life stage</td>
<td>33 d exposure to 45, 90, 140, 180, 360 or 720 µg/l (purity 96.2% w/w)</td>
<td>NOEC = 0.147 mg/l</td>
<td>ICI5504/0924</td>
</tr>
<tr>
<td>Daphnia magna (water flea)</td>
<td>Acute toxicity</td>
<td>48 h exposure up to 1000 µg/l at 20°C (purity 96.2% w/w)</td>
<td>EC50 = 0.28 mg/l</td>
<td>ICI5504/0928</td>
</tr>
<tr>
<td>Daphnia magna (water flea)</td>
<td>Chronic toxicity</td>
<td>21 d exposure to 0, 6.25, 12.5, 25, 50, 100, 200 or 400 µg/l, static system at 20°C (purity 96.2% w/w)</td>
<td>NOEC = 0.044 mg/l</td>
<td>ICI5504/0957</td>
</tr>
<tr>
<td>Scenedesmus subspicatus (green alga)</td>
<td>Effect on growth</td>
<td>96 h exposure to 0, 3.2, 10, 32, 100, 320, 1000 or 3200 µg/l, static water</td>
<td>E50C50 = 0.36 mg/l</td>
<td>ICI5504/0961</td>
</tr>
<tr>
<td>Apis mellifera (Bee)</td>
<td>Acute oral</td>
<td>24 h EPPO Guideline No. 170 ref. 2, (purity 51.6% w/w)</td>
<td>LD50 &gt;200 µg ai/bee</td>
<td>ICI5504/0862</td>
</tr>
<tr>
<td>Apis mellifera (Bee)</td>
<td>Acute Contact</td>
<td>24 h EPPO Guideline No. 170 ref. 2 (purity 51.6% w/w)</td>
<td>LD50 &gt;25 µg ai/bee</td>
<td>ICI5504/0862</td>
</tr>
<tr>
<td>Parasitic wasp, Aphidius rhopalosiphi</td>
<td>Dose-response on glass plate</td>
<td>48 h IOBC (Mead-Briggs et al. 2000), formulation 250 g/l SC (content 23.3% w/w)</td>
<td>LR50 &gt;625 ml/ha</td>
<td>ICI5504/2627</td>
</tr>
<tr>
<td>Predatory mite Typhlodromus pyri</td>
<td>Dose-response on glass plate</td>
<td>7 d C.E.B. No. 167 (Jan 1993), formulation 250 g/l SC (content 23.0% w/w)</td>
<td>LR50 &gt;5000 ml/ha</td>
<td>ICI5504/0006</td>
</tr>
<tr>
<td>Earthworm Eisenia andrei</td>
<td>Reproduction toxicity</td>
<td>Artificial soil, 14 d exposure to 10, 100, 180, 320, 560 or 1000 mg formulation/kg, 250 g/l SC (content 23.0% w/w)</td>
<td>LC50 = 881 mg/kg dry soil NOEC = 20 mg/kg</td>
<td>ICI5504/0903</td>
</tr>
<tr>
<td>Folsomia candida (Collembola)</td>
<td>Reproduction toxicity</td>
<td>28 d, ISO 11267, formulation 250 g/l SC, (content 25.1% w/v)</td>
<td>NOEC = 50 mg/kg</td>
<td>ICI5504/1319</td>
</tr>
<tr>
<td>Non-target terrestrial plant seedlings</td>
<td>Effect on seedling emergence</td>
<td>18 d, OECD 208 (purity 98.6% w/w)</td>
<td>NOEC = 20 mg ai/kg soil</td>
<td>ICI5504/1376</td>
</tr>
<tr>
<td>Soil micro-organisms</td>
<td>Tier 1</td>
<td>28 d OECD 216 &amp; 217 with formulation 250 g ai/l SC (content 22.8% w/w)</td>
<td>No effects up to 2.5 kg ai/ha</td>
<td>ICI5504/0960</td>
</tr>
<tr>
<td>Soil macro- and micro-organisms</td>
<td>Litterbag study</td>
<td>Field conditions, 188 d, formulation 250 g/l SC (content 24.8% w/v)</td>
<td>No negative impact on decomposition of soil organic matter</td>
<td>ICI5504/2319</td>
</tr>
</tbody>
</table>
## ANNEX 2. REFERENCES

<table>
<thead>
<tr>
<th>Syngenta document number or other reference</th>
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<tr>
<td>ICI5504/0006 2001</td>
<td>Azoxyrstobin: A Rate Response Laboratory Test to Evaluate the Affects of a 250g/l SC Formulation on the Predatory Mite.</td>
</tr>
<tr>
<td>ICI5504/0028 1993</td>
<td>ICI5504: Physico-chemical Study on Pure Active Ingredient</td>
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<tr>
<td>ICI5504/0081 1991</td>
<td>E5504: Acute Oral Toxicity to the Rat.</td>
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<tr>
<td>ICI5504/0082 1991</td>
<td>E5504: Skin Irritation to the Rabbit.</td>
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<tr>
<td>ICI5504/0083 1991</td>
<td>E5504: Eye Irritation to the Rabbit.</td>
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<td>ICI5504/0085 1991</td>
<td>E5504: Acute Dermal Toxicity to the Rat.</td>
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<td>ICI5504/0087 1992</td>
<td>ICI5504: 4-hour Acute Inhalation Toxicity Study in the Rat.</td>
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<tr>
<td>ICI5504/0088 1994</td>
<td>ICI5504: 21 Day Dermal Toxicity Study in the Rat.</td>
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<tr>
<td>ICI5504/0099 1992</td>
<td>ICI5504: 90 Day Feeding Study in Rats</td>
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<td>ICI5504/0101 1993</td>
<td>ICI5504: 90 Day Oral Dosing Study in Dogs.</td>
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<tr>
<td>ICI5504/0106 1994</td>
<td>ICI5504: 1 Year Oral Toxicity Study in Dogs.</td>
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<td>ICI5504/0108 1995</td>
<td>ICI5504: 2 year Feeding Study in Mice.</td>
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<td>ICI5504/0110 1995</td>
<td>ICI5504: 2 year Feeding Study in Rats.</td>
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<tr>
<td>ICI5504/0112 1994</td>
<td>E5504: Teratogenicity Study in the Rat.</td>
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<tr>
<td>ICI5504/0117 1994</td>
<td>ICI5504: Multi Generation Study in the Rat.</td>
</tr>
<tr>
<td>ICI5504/0122 1994</td>
<td>ICI5504: Developmental Toxicity Study in the Rabbit.</td>
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<tr>
<td>ICI5504/0140 1992</td>
<td>E5504: Assessment for the Induction of Unscheduled DNA Synthesis in Rat Hepatocytes In Vivo.</td>
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<tr>
<td>ICI5504/0161 1994</td>
<td>ICI5504: Acute Neurotoxicity Study in Rats.</td>
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<td>ICI5504/0163 1994</td>
<td>ICI5504: Sub-Chronic Neurotoxicity Study in Rats.</td>
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<tr>
<td>ICI5504/0824 1994</td>
<td>Aqueous hydrolysis at pH 5.7&amp;9 at 25 &amp; 50 degrees C of azoxystrobin.</td>
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<tr>
<td>ICI5504/0851 1992</td>
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<td>ICI5504: Sub-Acute Dietary Toxicity (LC50) to Mallard Duck.</td>
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<tr>
<td>ICI5504/0857 1997</td>
<td>ICI5504: A Reproduction Study with the Northern Bobwhite.</td>
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<td>ICI5504/0862</td>
<td>1994. ICIA5504: Acute Contact and Oral Toxicity to Honey Bees of a 500g/kg WG Formulation.</td>
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<td>1994. ICIA5504: Chronic Toxicity to Daphnia Magna.</td>
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<td>ICI5504/0961</td>
<td>1993. ICIA5504: Toxicity to the green alga Selenastrum capricornutum.</td>
</tr>
<tr>
<td>ICI5504/1259</td>
<td>1992. E5504: Skin Sensitisation to the Guinea Pig.</td>
</tr>
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<td>ICI5504/1272</td>
<td>1992. ICIA5504: Sub-Acute Dietary Toxicity (LC50) to Bobwhite Quail.</td>
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<td>1994. A Toxicity Test to Determine the Affects of Azauxostrobin on Seedling Emergence and Growth of Terrestrial Plants.</td>
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