Glyphosate:

Commercially Available Options

Prepared for Auckland Council

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Contents

Executive Summary

A review of commercially available glyphosate products in New Zealand has identified at least 30 formulations from 11 different suppliers/manufacturers, that may be considered as options for Auckland Council (AC) contractors to use. In many cases, the publically available information failed to identify whether there was an additive present or what that additive might be. In these circumstances, the supplier was contacted directly and many did provide details of the class of surfactant although often this was supplied on a confidential basis.

The products were assessed for relative toxicity and human health hazards on the basis of the additives. Consideration of the human health hazard ratings were important to ensure that Council is cognizant of the health and safety implications for its contractors, who handle and mix these products.

The products were grouped:

- RED: contains POEA or another toxic surfactant and/or has a corrosive rating,
- ORANGE: POEA unconfirmed and/or had eye/skin irritation hazards, and
- GREEN: no POEA and no human health hazard ratings.

While most glyphosate products in NZ still contain the tallow amine ethoxylate (POEA), there is a growing list of products that contain less toxic surfactants. At present there are two suppliers in NZ who supply two “green” glyphosate formulations each, and a third supplier S 7(2)(b)(ii) 3rd Party Comm has confirmed that they are working on a new POEA free glyphosate formulation.

This review recommends that Council consider the use of the least toxic glyphosate products for contract maintenance works in areas that are accessible by the general public.

1. Introduction

Auckland Council has responsibility for weed control within parks, reserves, sports grounds, gardens and restoration areas. This work is undertaken using a variety of weed control methods, including the use of agrichemicals and glyphosate. Internationally, the recent European assessment of glyphosate has identified potential concerns around the toxicity of the additives, namely, the surfactant (or surface active agent).

Auckland Council is keen to understand the formulations of the commercially available glyphosate products in New Zealand, with a view to ensuring the least toxic formulations are used for Council works where possible.

The review has identified more than 11 manufacturers in NZ with a long list of different formulations, suitable for different purposes. The primary purpose of glyphosate manufactured in NZ appears to be related to weed control in agricultural environments and pasture. Thirty one different products were reviewed for the purposes of this report, with those products clearly containing more toxic components being excluded.

2. Scope of the review

The scope of this review was to:

- Research the current commercially available glyphosate preparations to establish a list of products.
- Identify the components and additives of each product, contacting the suppliers/manufacturers for further information if required.
- Prepare a brief report listing the available products, the chemical components and a discussion on the relative toxicity and hazard associated with each product (based on available information).

The information on each product was taken from the publically available Safety Data Sheet (SDS) (previously called a Material Safety Data Sheet) and from verbal discussions with the manufacturers where additional information or clarification was sought. At times the product information did not identify the additives and in some cases the suppliers provided commercially sensitive information. The suppliers contacted are identified with * in the summary table in Appendix A.

3. Glyphosate

Glyphosate exists in different forms (as salts with different counter ions) and it is the glyphosate acid that is the active component. The concentration of the active ingredient present in the different products is often confusing, with suppliers quoting the salt concentration and others the acid concentration on the labels. Traditionally the acid is quoted and the form or salt then identified, such as 360g/L glyphosate as the isopropylamine (IPA) salt. This actually refers to glyphosate acid at 360g/L with the IPA salt present at a concentration of 486 g/L. See Table 1 for the acid equivalence of the salts. Some suppliers will sell this product as Glyphosate 480 giving the impression that it is a more concentrated formulation.

Table 1. Common Salts of Glyphosate

Glyphosate Salt	Acid equivalent
Isopropylamine (IPA)	74%
Dimethylamine	79%
Potassium	81%
Ammonium	90%

4. Commercially available products

A list of the suppliers and products reviewed for this report is shown in no particular order in Table 2. The products are comprised of different glyphosate salts in varying concentrations and are reported as either a weight/volume mix or as g/L in solution. There are also a few dry products, listed in g/kg.

Table 2. Suppliers and products reviewed

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5. Additives

All of the glyphosate products reviewed contained one or more additives, as glyphosate typically needs to be applied with a surfactant or wetting agent to be effective. The wetting agent enables the large glyphosate molecule to pass through the cuticle or outer membrane of the foliage. Additional surfactant may be tank-mixed with the glyphosate product as required to achieve the required wetting, depending on the foliage being treated. Auckland Council contractors may add a further surfactant to increase the uptake/effectiveness if rain is imminent or the weeds are particularly dusty.

There are a number of classes of surfactants and these are based around the molecular structure of the compound. These ingredients are often misleadingly labelled as non-hazardous or inert as the SDS reporting rules do not necessarily require these additives to be identified if they have been considered non-hazardous. With the recent focus internationally on the license renewal of glyphosate in Europe, the toxicity of the additives is now being scrutinised more closely. Commercially available formulations of glyphosate are known to often be more acutely toxic than pure glyphosate.

Below is a quick summary of some of the surfactants commonly added to glyphosate formulations. The additives in the commercial products reviewed for this report are shown in Table 4. While many of the products specifically identify the additives, there are quite a number that identify the additives only as “surfactant” or “inert or non-hazardous ingredient”. In this instance the NZ supplier was contacted directly and asked for further information. In some cases, the supplier provided details of the additives on a confidential basis, in others, the suppliers declined to respond or provide further information. Three of the products did not identify any additives but the hazard ratings indicated more than just glyphosate present in the formulation.

5.1 Toxicity Information

The standard surfactant traditionally added to glyphosate is polyethoxylated tallow amine (POEA) – a non-ionic surfactant. The POEA surfactant (tallow is a mixture of fats with different chain lengths) has typically provided good wetting qualities and is easily mixed with glyphosate. Recent assessments of POEA however, have identified that the surfactant is more toxic than the glyphosate active ingredient.

Other surfactants include alkyl polyglycosides or APG. These are also non-ionic surfactants and are water soluble with excellent wetting properties, but maybe slightly less effective than a POEA/glyphosate mix. APGs are made from renewable raw materials, derived from sugars, usually glucose. APGs are used to enhance the formation of foams in detergents for dishwashing and for delicate fabrics and have excellent skin comparability. In addition to their favorable foaming properties, they are attractive because they are biodegradable and have low environmental toxicity.

Cationic surfactants include compounds such as amidoamines. These compounds are typically used in soaps, shampoos and cosmetics. The compounds are typically derived from plant based fatty acids such as coconut and may cause skin irritation or allergies.

Anionic surfactants include species such as general soaps, linear-chain polyoxyethylenes and linear alkylbenzene sulphonates (LAS) which are produced in the large quantities worldwide. These are mainly used in liquid and powder based laundry detergents. Alkyl polyoxyethylenes typically also exhibit a low toxicity.

Pelargonic acid is a naturally occurring fatty acid, present in many plants. This rancid smelling oil is almost insoluble in water but is often mixed with glyphosate to increase the speed of knock-down. It is also used for weed control around food-crops, such as orchards, where a 24-harvest restriction minimises the residue on the fruit post-treatment. Toxicity on non-target species such as bees, birds and fish has shown little or no toxicity and the compound is readily biodegradable.

5.2 Toxicity Information

Toxicity information is required to be reported on the SDS for each product, and while all sheets typically include test values, there are usually no references. At times the data from a similar or related product is used. The LD_{50} (lethal dose) refers to the concentration of a product which administered over a certain time period to the test species results in death 50% of the time. The LD_{50} for oral exposure of rats for the various additives is shown below (Table 3), where the concentration is reported as the weight (mg) of product given per kg of body weight in the test species. These values have been taken from the safety data sheets and are indicative only as many references/sources do not specify the time period (typically it is 3 days).

Table 3. Indicative Acute Oral LD_{50} (rat) values

Additives	Oral LD_{50} (rat) mg/kg
Glyphosate (average value)	>5000mg/kg
Tallow Amine (POEA)	1200-1300 mg/kg
Polyglycosides (APG)	>5000mg/kg
Polyoxyethylenes[1]	>1200-5000
Pelargonic acid	>2000 mg/kg

[1]For a mixture of chain lengths.

While the reported LD_{50} values are indicative of the general toxicity to rats, these values are for the additive (and glyphosate) alone. When added to glyphosate, the additive typically comprises less than 20% of the mixture, so the additive is used in the glyphosate formulation is diluted compared to the toxicity test data.

5.3 Hazard Ratings

Safety Data Sheets (SDS) identify the health or environmental hazards associated with each product. SDS documents must be updated regularly to ensure the sheets are not greater than 5 years old. The ratings are assigned by the Environmental Protection Agency (EPA) at the time of product registration. The ratings assist with identification of the less hazardous products; however, the ratings are not updated over time to reflect new information, even though the SDS date is. This means that the rating information on the latest SDS for a product registered 10 years ago might be inconsistent with the ratings that the EPA might assign this product if it was being registered for the first time this year. For this reason, the date of product registration has also been included in the spreadsheet of reviewed products (see Appendix A).

The hazard ratings are allocated to human health and environmental categories and are ranked from A to D or E depending on the severity of the effect, with A being the most acute and E being the least. No hazard rating means that product does not cause a hazard in this category. All products reviewed had a rating for environmental hazards, with the most common being 9.1B (ecotoxic in aquatic environment) or 9.1D (slightly harmful to aquatic environment). Other environmental ratings included: 9.1A (very ecotoxic in aquatic environment), 9.2B (ecotoxic in soil), and 9.3C (harmful to terrestrial vertebrates).

The human health ratings included:

- 6.1 D and E (acutely toxic – harmful or may be harmful as aspiration hazard)
- 6.3 A and B (irritating to skin or mildly irritating to skin)
- 6.4 A (irritating to eye)
- 6.8 B (suspected human reproductive or developmental toxicant)
- 6.9 B (toxic to human target organs or sys)
- 8.2 B corrosive to dermal tissue
- 8.3 A corrosive to ocular tissue.

5.4 Assessing Products

The objective of this review was to identify the least toxic formulations of glyphosate commercially available in NZ and understand the relative toxicity of the additives. POEA has been identified internationally and through a recent MSc study for the Department of Conservation, as more toxic to lizards and other species than glyphosate. On this basis products containing POEA were flagged as "red". The presence of other toxic surfactants (although not necessarily identified) also resulted in a "red" rating. All other products that have category 8 corrosive hazard ratings have also been flagged as "red" due to the potential health and safety issues for contractors' handling/mixing/diluting these products. A list of the products is shown in Table 4.

Products identified as "green", with the lowest toxicity, identified only aquatic hazards, with no human health ratings noted. These products were confirmed as not containing POEA. While other products (in particular, the Monsanto ones) also only identify the 9.1 B hazard rating, the supplier did not respond and/or confirm that no POEA was included in the formulation. S 7(2)(b)(ii) 3rd Party Commercial Position

Products identified as “orange” either:

- The supplier did not respond or confirm that no POEA was included, or
- The product SDS included human health hazard ratings.

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6. Recommendations

The review of commercially available glyphosate products in New Zealand has identified at least 30 formulations from 11 different suppliers/manufacturers. In many cases, the publically available information failed to identify whether there was an additive present or what that additive might be. In these circumstances, the supplier was contacted directly and given the opportunity to provide further information. Many did provide details of the class of surfactant although this was often supplied on a confidential basis.

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Safety Data Sheets for the products reviewed.

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