A perspective on Chelating agents and related technologies

We hear a lot of rumors, statements, facts, opinions etcetera when it comes to chelating agents. Which is the best one? Which is the most cost effective one? Which is the most sustainable one?

We will try and give you an as objective view as possible, but the question you might ask yourself is: Who are we to attempt giving an objective view? Our answer – A complete supplier providing most of the chelating agents out there today. We can actually ignore marketing one product against the other. You can buy most of them from us and we will even guide you in your selection if you wish!

Chelating agents are an essential ingredient in numerous applications such as pulp bleaching, agrochemicals and not the least in cleaning such as textile washing and vehicle cleaning.
Why? There is one technical function that can only be performed by a chelating agent: Removal and passivation of metal ions.
One might argue there are some other technologies that can do the same – Most likely true, but not at the same level of performance!

Some well known examples:

The most well known chelating agent is EDTA, ethylenediamine tetraacetic acid, a very well performing chemistry that has served and will continue to serve many years ahead. The issue? It can not be degraded by the normal range of bacteria, but needs certain strands. So why would this be an issue? Not being degraded means it will stay in the environmental systems and continue doing its job. So what? The problem is the initial job is done so now it has to find another and unfortunately this has negative consequences. One immediate example is the chelation of heavy metals. Otherwise immobilized and passivated heavy metals can gain movement and start to move into the Eco systems…

Another well-known chelating agent is STPP, sodium tri polyphosphate, not only a chelating agent, but also a powerful dispersant and more. Therefore it has found its place within dish- and textile washing. Hopefully we can put an end to its unnecessary use very soon! Why? Its spreading in nature contributes to eutrophication, resulting in undesired plant densification. Besides this, the phosphate is needed for the desired fertilization to produce food. Do we really want to use it in washing clothes and other?
Connected to phosphates are organophosphonates. In similarity to phosphates, since they are partly based on the element phosphorus, they also need to use phosphates as an indirect resource.

Last but not least in the range of chelating agent historical examples is NTA, nitrile triacetic acid. In similarity to EDTA also a well performing chemistry, but it is also biodegradable! The issue? It has an indicated negative effect on animal and human health. It is suspected of causing liver cancer amongst others.

In this range of examples we have decided to exclude weaker chelating agents such as citrate and IDS. Why? Simply because they are weak and not a "true" chelating agent per say. In order to be classified as a "true" chelating agent the relative chelation power (mole M^{n+} per chelating agent)

needs to be close to one. So, citrate and IDS do not work? Yes they do, in many cases where the performance of a "true" chelating agent is not a must.

The next generation – developed to be "green":

As exemplified above we have some challenges when it comes to "old technology" chelating agents. As a result a range of biodegradable and more or less non-toxic alternatives have been developed. So what is the challenge? They already exist – start using them! Most of the time there is one true challenge and one indirect challenge: 1, Performance – most of the time these alternative technologies are not performing under the same circumstances 2, The cost.

The latter is getting some help from voluntary schemes, however still the allowed use is a problem. As with many other things – if not cheaper, only legislation will change the game. And it will, it just takes time.

Returning to the performance, one example is the replacement of phosphates. As phosphates not only has the ability to act as a chelating agent, but also a powerful dispersant (and more), we need a friend to accompany the alternative technical features. The friend is very often a polymer and sometimes referred to as a Co-builder. The role of the polymer is to take on the task of crystal growth inhibitor and also dispersant, the two additional actions provided by the phosphate.
In summary, we cannot rely on our old formulations and pretend these chemistries are direct drop-ins. We need to use our formulation skills. In specific cases we also need to realize that there are no existing alternatives, one example is in chelation of specific metal ions and/or chelation in specific conditions such as low pH. In these cases we simply need to stick with what works and at the same time develop alternatives.

So which is the best chelating agent today?

The answer, unfortunately, is: It depends.

It depends on:

- What is to be extracted/passivated?
- At what conditions?
- What are the environmental considerations?
- At what cost?
- What is it to be mixed with?
- What are the extraction requirements?
- And much more

Once sufficient performance is checked, often the selection comes down to either cost and/or to more soft criteria such as renewable content, tox profile and others.

If you ask us, weighing in all perspectives, we chose MGDA and GLDA. Why? They are readily biodegradable, non-toxic and on a relative scale efficient and cost-effective alternative. The majority of uses can be covered by these two chelating agents.

So, if I have to choose one? Ok, so then let´s do it like this:

When to choose MGDA: You want a high performing chelating agent, readily biodegradable, non-toxic. You want to "go green". You do not suffer from formulation stability issues or you have solid compositions (MGDA can be obtained in crystalline form). MGDA is manufactured using bio-based sodium alaninate, which renders it by definition 43% naturally based with an RCI (renewable carbon index) of 40%.

When to choose GLDA: You want to "go green" as far as possible and also make your formulations as future secure as can be today. You want a high performing, readily biodegradable, non-toxic chelating agent with its basis from a natural raw material. GLDA cannot crystallize so your formulation stability is guaranteed from the chelation point of view. GLDA is based on monosodium glutamate, resulting in a 56% RCI (renewable carbon index) and a renewable content of 48%.

To conclude

As with everything, choosing is not easy. There are pro´s and con´s in all decisions and no matter how you choose it is called a choice for a reason.
We try to be objective in selecting components and if you would have any comments or questions please do not hesitate to contact us. In addition, if you are looking to source product, we will help you select in an objective manner. We can supply the majority of products mentioned in this "perspective".