Formulating cleaning products

– Past to present and into the future

Ever since the start of using soap, dated back as early as 2.800 b.c., there has been a constant development and evolvement of ingredients for formulating cleaning products. The large-scale production of nonyl phenol ethoxylates (NPE's), starting around the 1940's, can more or less be seen as the kick-off for formulation of todays high-performing cleaning agents. Together with the birth of NTA and EDTA, the former dating back to as early as the mid 1800's, the basic composition of high-performance cleaners started to take shape. Although many detergents for laundry still today contain phosphates, the use of pure complexing agents in combination with anionic polymers are gaining ground by the day.

Today's formulations are highly effective so why do we care about developing new ingredients?

Well, the driver is the (potential) impact on 1, the environment/climate and 2, human health. Starting with the surfactant base NPE's, which are to a large extent already replaced in the developed countries, they degrade into nonyl phenol which has been found to affect hormone levels in humans and animals. The development lead into alternative alcohol bases for these highly efficient components and today the alternatives come in many shapes (around C8-C12 alkyl ethoxylates) with slightly varying properties and efficiencies. The first stage was to replace nonyl phenol (NP) with other synthetic alcohols. At present the drive to abandon fossil-based sources calls for naturally based alcohols instead. Looking at the complexing agent part, NTA and EDTA were found to be either toxic or indirectly toxic. Most of us know the trend of replacing NTA by EDTA. Furthermore, most people know there is a strive towards replacing EDTA. Why? When EDTA has performed its function and is subject to outlet in the nature, it finds issues degrading. The lack of biodegradation results in EDTA keeping its function, a function well-appreciated in the intended product but dangerous when allowed to persist in nature. EDTA stays and attracts heavy metal ions, which through EDTA is then made available into the food chain. This means EDTA contributes to animals and humans absorbing heavy metals. So what is the issue with phosphate? Phosphate is a naturally occurring mineral. The issues with using phosphate are two: 1, It is an ending resource, once spread into nature it will not "reform" within a reasonable time. Furthermore it´s access is crucial for modern agriculture. If we cannot add phosphate into our farming the efficiency of it will be much less. 2, It performs its crucial task also outside of farming. Phosphate does not recognize

when to contribute to biological growth and when not. It will perform its job where it ends up. There is a problem with phosphate performing its job in oceans, rivers and lakes. As mentioned in the beginning the issues with using phosphates have resulted in its function being replaced by chelating agents in combination with anionic polymers. These anionic polymers are mostly derived from acrylic acid and its derivatives, acrylic acid in turn being produced from propylene, a fossil based raw material. Even if there is little worry about polyacrylates as such they do persist in nature and its final effects are not fully elucidated.

So where are we today?

We at KRAHN Nordics work with a range of chemical ingredients, all of which find their place in various applications. The ingredients on their way to be replaced will, for the good and for the bad, still be used for a long time. The least we can do is to use them as effectively as ever can be. However, our focus is on continuously replacing things for the better and as developments are made available.

For cleaning we have a portfolio of ingredients where we have strong belief for the future:

Berol Surfboost AD15 A co-surfactant and hydrotrope, based on a natural fatty acid. Berol Surfboost AD15 is the latest high-performing co-surfactant replacing slightly toxic and not anaerobically biodegradable alternatives. A co-surfactant by the way is something that in combination with others can bring higher efficiency into a product, a sort of bonus effect for free resulting in "use of less". Berol Surfboost AD15 is our primary choice for medium electrolyte containing degreasing products.

Berol 360 and Berol 366 (Berol 36X) Berol 36X are two alcohol ethoxylates having a natural fatty alcohol base. Furthermore, just like their predecessors they are based on narrow range technology which has a positive impact on their performance as such, the presence of impurities (foremost residual alcohol) and also foaming behavior. The result is a possibility to use less compared to non-narrow range alternatives. Berol 36X are the wetting agent and emulsifier base for the future.

Dissolvine GL-47-S The most recently developed chelating agent, GLDA, highly suitable for inclusion in cleaning products and others. Biodegradable and nontoxic. It is the chelating agent with the highest percentage of natural origin, fully bio-degradable, and through its non-crystallizing behavior it is the most physically stable option to formulate liquid cleaning products. Also shown to be more efficient than its counterparts such as MGDA. Poly-L-aspartic acid A fully biobased and biodegradable anionic polymer, replacing traditional polyacrylates in generating the complete builder system. With both its properties of preventing scale (crystal growth) and dispersing microparticulate soil, it is a crucial component of almost every cleaning product.

Where are we heading?

Besides critical components there are two major parts as we see it: 1, Putting formulations together based on what is available. 2, Planning for what is to come. The future of chemical ingredients is very much dictated by voluntary schemes such as Ecolabel and also authority initiatives such as Green deal and regulations of public procurement. Our belief is that the next step following above is to base the products on natural ethylene. The ethylene oxide used in several of the products is still fossil based. This is of course interim, however considering the efficiency of the chemistry we see it as highly unlikely the chemistry as such will be replaced. It is more likely the components are converted into a bio-base. This is already happening today, however before it reaches "commercial scale" some time remains. The same goes for the components of e.g. GLDA that are not of bio-origin. These are indirectly based on propylene and others and just like ethylene propylene is likely to see a bio-route for its production with time. These are basically the last steps we need to take to have a fully circular bio-economy. With time, and as the 100% bio-based products become standard further developments on the performance side are very likely. Better performance – less use. Development never stops. In summary, the "future portfolio" is almost at its final destination and we are very confident about both the performance and also the future security of these components. The future security is very much connected to regulations and other "regulatory drivers" (e.g. eco-label). We see primarily three factors being in focus: 1, low toxicity 2, full biodegradability 3, 100% bio-base. All three factors are being accounted for and taking the last step into bio-based ethylene and propylene will allow for "full compliance".