Primeaux Associates LLC

Polyurea Technology & Application Consulting

Technical Note

Does Polyurea Hold up to BigFoot Blood?

A Chemical Resistance Story

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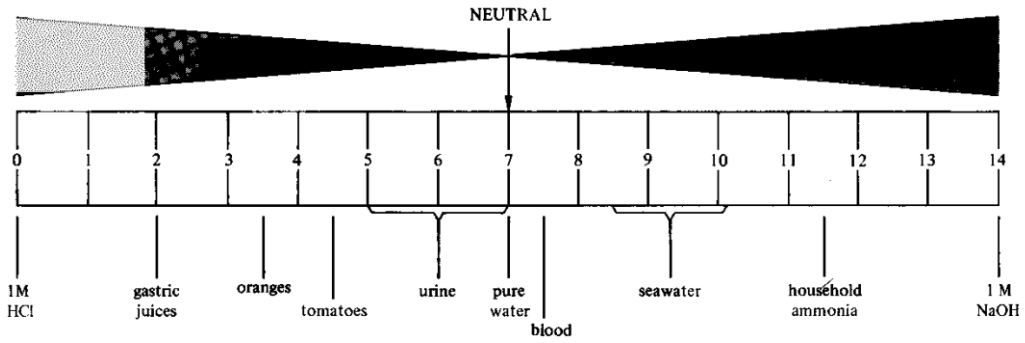
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Technical Note: Polyurea and Bigfoot Blood

I can't begin to tell you how many contacts I get a week from people wanting to know if a ***polyurea*** system will hold up to a certain chemical, some strange, some common materials. But more specifically and often, they inquire as to if ***polyurea*** will hold up to just a certain pH. Seems like a simple question right? While I really do not mind receiving the contacts and inquiries, it is not really a question that is so easy to answer. Why, well not enough information has been provided.

So first, let's look at the pH part of the question. In our chemistry world, pH is the "Potential Hydrogen", measured as the $-\log_{10}$ (H^+) hydrogen ion concentration. Or in the case of basic / alkaline conditions, we use the hydroxide (OH^-) ion concentration, and subtract from 14. Sounds complicated right, but hold on a minute, it's pretty "simple" in a way. You can also check Wikipedia for more info to brush up on your chemistry.

For pH, we use a scale as shown below. This scale runs from 0 – 14, with 7 being neutral. Anything less that 7 is acidic, and that above 7 being basic or alkaline. The lower the number, the more acidic, while the higher the number, the more alkaline. The change in pH numbers from one to the next represents about a 10 fold change in percent "concentration".



For purposes of this discussion, from an acid standpoint, simply we have either inorganic (mineral) and organic based acids. Examples of inorganic acids would include hydrochloric (HCl), sometimes called muriatic acid, nitric (HNO_3) also referred to as aqua fortis, and there is a ***fuming*** version of this by the way (and you would think it was mad if you saw it), phosphoric (H_3PO_4) and sulfuric (H_2SO_4) acid to name a few.

But not to complicate matters, if we look at acids based upon the halogen series, and that being HCl, HBr (hydrobromic) and HF (hydrofluoric), these are most definitely not the same. A similar pH of each one of these will have significantly different results in exposure to a *polyurea* coating or lining.

And then there are organic acids such as common ones that include acetic, lactic, and citric that may be encountered in *polyurea* coating / lining work. Organic acids may tend to be a little more aggressive than mineral based at the same pH level.

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A dilute trichloroacetic acid solution, pH 2 let's say, will eat right through most *polyurea* systems, while a dilute acetic acid, same pH as above, will be fine in exposure.

So for example, let's say that we have a hydrochloric acid solution at a pH of 2, and that represents about a 0.036% aqueous HCl solution. A pH of 1 is about 0.36%, while ~3.6% solution is a pH of about 0.5. And if you note, most *polyurea* systems will hold up to room temperature exposure of a 10% HCl solution, a pH value of < 0.5.



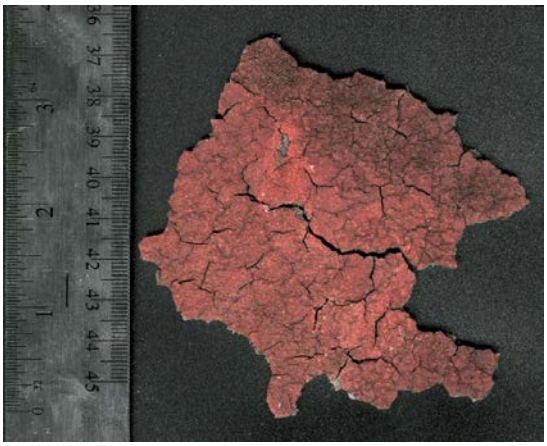
Additionally, **HCl** (Hydrochloric acid) and sodium hypochlorite (Na**HCl**O_3) are NOT the same. The picture on the right shows samples of polyurea, with the left exposed to ~12% $NaHClO_3$ (common bleach) and the right to 10% HCl for 72 hours, where surface oxidation and discoloration is present….

Acids and bases can also be used in aqueous solutions to aid in dissolution of certain chemical compounds or salts. While this "acid" or "base" may not be disclosed specifically on the Safety Data Sheet (SDS), look at the pH noted of the material and this can provide some additional information. So chemicals used as well as pH, is an important combination to know.

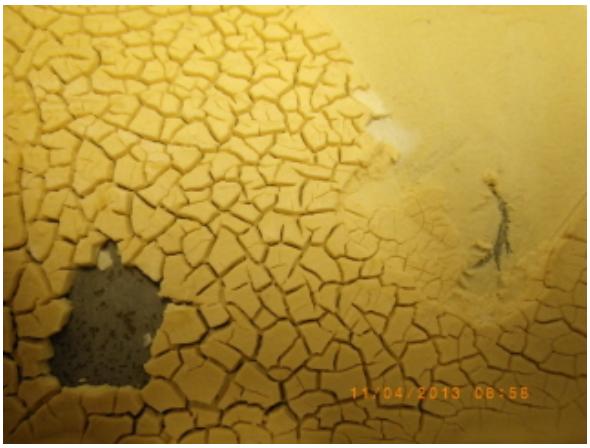
I will note here that *polyurea* systems in general hold up better to alkaline conditions / exposure as compared to an acidic environment. But this does not mean they cannot be used in acidic environments, we just need to know a little more information.

In additional to acid or base, there are also various solvents and chemical exposures that have to be considered, as well as that concentration of the chemical. Some chemicals are strong oxidizing agents, such as sodium hypochlorite (bleach), $NaHClO_3$.

Below are a couple examples of the effect of chemical on a *polyurea* elastomer:



Acid / Oxidation Attack



Solvent Attack

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The next consideration will be exposure temperature. Certain *polyurea* systems may hold up well to an acid, chemical, etc. at 77^0F (25^0C) but will fail if that temperature is elevated, say even to 120^0F (~50^0C). So knowing this as well is a valuable piece of information that is required.





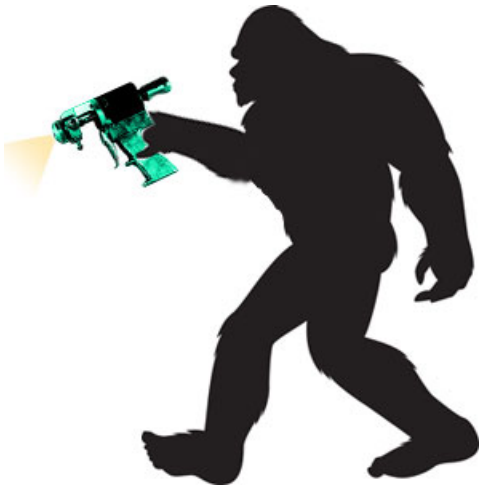
Heated Oil Exposure

Also, *polyurea* is a technology, as there are numerous formulation possibilities, and not all are the same! You need to know what *polyurea*, and if aromatic or aliphatic based. And just as a side note, aliphatic "modified" *polyurea*'s, which are by the way good materials, are still considered aromatic based when it comes to most chemical and UV exposure.

So you see to answer the question, you need to ask more questions and gather important information. This will ensure a successful *polyurea* project, and that is what we want. Will also let you know if you need to "walk away", and don't be afraid to do that either.

Oh and most important, get the information related to chemicals and exposure temperature in writing / documented! This will protect all parties involved in the end.

So now as far as Bigfoot Blood, I would have to assume that it is similar in make-up to other mammal "blood" and yes, *polyurea* should hold up well to that exposure. But if in doubt, you bring me a Bigfoot and we can test if need be……



Note: The original version of this article, written by the same author, appeared on the Polyurea.com website, January 2011.

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