RioTinto

Transcript

Things You Can’t Live Without

Episode 7 – Buddha Lo’s salt

No. of words	1,197	Time	25 minutes

*****Check against delivery*****

Dr Anna Ploszajski [00:05]
We're back with another episode of Things You Can't Live Without, the science podcast where I, material scientist Dr Anna Ploszajski, ask my guests to reveal the single item that they can't live without. We're interested in how this stuff came into existence. From mining to processing to making it. And we'll be accompanied on this journey by a host of experts who are going to be helping us with all the behind-the-scenes science that goes into creating the everyday.

They'll also help us to gaze into the future to answer the question, if we can't live without this stuff, then what are we prepared to change in order to live with it sustainably? Today, I'm honoured to have with me Buddha Lo. For the cooking enthusiasts amongst us, Buddha needs no introduction. Born in Australia, he began working in the kitchen of his dad's restaurant when he was just 12 years old.

He's worked in Michelin star restaurants across the globe and founded some of his own. In 2022, he became a contestant in the American TV series Top Chef, which he went on to win, not once, but twice, the first person ever to do so. Buddha, welcome to Things You Can't Live Without.

Buddha Lo [01:11]
Hi Anna. Thank you so much for having me.

Dr Anna Ploszajski [01:13]
I'm so excited to talk to you. And I imagine you're somebody who knows their way around a kitchen. You've got a kitchen gadget or two, I'm certain. But tell us, of all of those, what's the one item you can't live without?

Bhudda Lo [01:27]
Anna, the one item I can't live without is salt. You'll find that in every single kitchen all around the world. And just like my kitchen, I cannot live without it.

Dr Anna Ploszajski [01:37]
Such a basic ingredient. Everyone has it in their kitchen. Why is it so ubiquitous around the world?

Bhudda Lo [01:44]
Salt is a flavour enhancer. It's so important that it just brings out natural flavours and just makes things just taste so much better. But not only that, it's also something that we need to survive on. We literally cannot live without salt.

Dr Anna Ploszajski [01:59]
Yes, you can't, we can't, we all need it in our lives. It's an interesting material, this one, because all of the materials we've featured on this podcast so far have been finite resources in some way, but salt is a bit different, because thanks to our oceans, we could be fairly safe in the knowledge, at least in the short to medium term, that we're never going to run out of salt.

But having said that, the practice of extracting and processing salt, of course, takes some form of energy, so it doesn't get to escape our scrutiny when it comes to sustainability and pushing for net zero. And as we're going to find out, salt is integral, not just to the kitchen, but also is a fundamental ingredient in many industrial processes behind-the-scenes that are making materials, making stuff for our world as well. To tell us more about all of that and more is Rio Tinto's Chief Advisor of Process Development, Amy Lamb. Hi, Amy. Nice to meet you.

Amy Lamb [02:52]
Hi, Anna.

Bhudda Lo [02:53]
Hi, Amy.

Amy Lamb [02:54]
Thank you for having me.

Dr Anna Ploszajski [02:55]
Welcome, Amy. I'm so excited to talk to you about how we get from sea to salt. But first, Bhudda, I'd love to hear, I guess, a bit of your personal journey with this special ingredient.

Bhudda Lo [03:07]
Well, like you said, it's something that people need in their diets, but it's so important. I mean, I literally have my career hanging on this one, one particular item. If I under season it, I'm going to be told that, that's not correct. If I over season it, it's not going to be correct. So, so it is so important. I cannot create food without it.

Dr Anna Ploszajski [03:31]
So, what are all the ways that you use salt in the kitchen?

Bhudda Lo [03:34]
We use it literally for every single thing that we cook. The golden rule for us in the kitchen is actually I learned that when I was, when I was an apprentice in a hotel, I under seasoned something or I didn't put salt in particular stocks or broths or water. So yeah, he would say salt everything, including your water. That is something that has been ingrained in me into making sure that, everything is seasoned. So, you're going to find salt in every part of the kitchen.

Dr Anna Ploszajski [04:06]
I love that. I'm going to start doing this as well. Just putting little pots of salt all over. Although my kitchen is much smaller than yours, I'm sure.

Bhudda Lo [04:12]
Yeah. I live in New York City, so it's pretty small.

Dr Anna Ploszajski [04:16]
Oh yeah, fair enough. I meant your work kitchen.

Bhudda Lo [04:18]
Oh, my work kitchen. Oh, even work kitchens in New York City is pretty small, so, yeah. [music interlude]

Dr Anna Ploszajski [04:25]
I was given a gift recently, which was, a friend of mine had come back from holiday and she gave me a gift of salt, funnily enough. And, it was four little pots of it. One of them was black with activated carbon in it. One of them was pink with something else in it and all these different types. Is that a real thing? You know, how different are different types of salt?

Bhudda Lo [04:47]
As a chef and cooking, or every single day, I don't actually use other different types of salts. I don't find that the impact of it is going to change it to a different level. I guess what would probably change things is actually more salts from different natural ingredients. Maybe something that has been salted. Soy sauce, maybe anchovies or cheese. I find like the salinity that you get from, you know, these sort of processes is actually far greater than, than the different, types of salts that are out there. But yeah, that's in, in kitchens, we'd never go, hey, pass us the volcanic salt, you know, it's not going to change your life, you know.

Dr Anna Ploszajski [05:33]
You mentioned sweet dishes earlier. I've got an incredibly sweet tooth and I love salty, salty and sweet together.

Bhudda Lo [05:40]
Yeah.

Dr Anna Ploszajski [05:40]
And I actually, my sort of main, I guess, encounter with salt is actually as a sea swimmer. I spent a lot of time doing long distance open water swimming in the sea, which is a very salty environment. And so I went down this sort of research rabbit hole a little while ago about like, have you heard of Battenberg cake?

Bhudda Lo [05:58]
It's the cake with the, squares…

Dr Anna Ploszajski [06:01]
Yeah, that's right.

Bhudda Lo [05:58]
…inside of it?

Dr Anna Ploszajski [06:02]
Pink, yeah, pink and yellow squares with marzipan around the outside.

I found this research that showed that there's a receptor, it regulates how it communicates with the outside world. And what it does is it transports sugars into cells, but only when sodium is present. And this was found on the sweet taste buds on mice. So, basically, what this finding was saying was that these sweet taste buds would only kind of trigger a feeling or a flavour of sweetness to the mouse in the presence of sodium, which is salt.

Bhudda Lo [06:35]
Yeah. And I believe that, uh, I, I think I was learning that it opens the taste buds as soon as the salt touches your tongue. It opens your taste buds and it allows more flavour to come in and I don't think life is worth living unless you're tasting the maximum flavour so.

Dr Anna Ploszajski [06:54]
I want that on a t-shirt. I love that. Amy, I'd love to turn to you and ask you, do you have any, either kind of salty mishaps or do you feel particularly strongly about any unconventional uses of salt, like in tea or coffee or even unsalted butter? Where do you stand on this?

Amy Lamb [07:14]
I actually will admit I've never tried salt in my coffee, so I'll have to give that a go sometime. See, see how that changes the flavour of my cappuccino in the morning. But I did have a salty mishap once. I brined a turkey for Thanksgiving one year. So, after brining the turkey, you had the juices, and of course you make gravy with the juices from the turkey.

Not realising the salt content, I didn't taste it beforehand, and I ended up with very salty gravy, so I ended up using instant gravy for my Thanksgiving feast, which I was not, I was not happy about, but, I did, lesson is very much learned, when brining meat, the juices are very salty, so be careful how you use them.

Dr Anna Ploszajski [08:00]
That's a very good lesson to learn. I'm sure you won't make that mistake again, and I'm glad you were able to salvage it with, you know, some instant in the cupboard. [music interlude]

So Bhudda, you've beautifully explained, you know, the significance of salt to the art and the craft of cooking. And I looked up, you know, where the word salt comes from, it's actually from the Latin word, sal. And funnily enough, the word salary, you know, like paycheck, comes from the same word for salt. It relates to the fact that the Roman soldiers were given monetary wages in order that they could go and buy salt. So, it was seen as like such a, an important and integral ingredient for them that they had, you know, their wage packet to cover it.

It's amazing when you start looking into it, that salt is not only important for our health and for, you know, the enjoyment of food.

But it's also a surprisingly integral part to making loads of industrial processes happen and loads of materials that we, that we use, things like glass, like most glass that we have, the sorts of glass that you would have in a restaurant to, to drink from, for example, that's a type of glass called soda lime glass, and the soda part of that is sodium from sodium chloride.

Similarly, with like plastics like PVC, polyvinyl chloride, the chloride part of that comes from sodium chloride. And the biggest use. Probably the one that people will think of the most is in de-icing and making sure the roads are safe in the wintertime. So, we have, we have a huge amount to be grateful for with salt, not just for deliciousness, but also for, for, you know, loads of the materials in our material world.

Going back to the de-icing usage, salt changes the freezing temperature of water, but it also changes the boiling temperature, right? And that, that's a common use in the kitchen, isn't it? How do you use it to kind of modify boiling temperature?

Bhudda Lo [09:54]
Yeah, so that's very interesting as you're saying it. As you're saying it, I was like, the heating and the cooling of adding salt to water, it's really weird because it does, and I'm hoping that you could probably explain it a little bit more, but yeah, the temperature of water is 100 degrees boiling, but when it goes, when it has salt in it, it does increase to about, I believe, about 107, maybe 110.

You know, you want to keep that process. If you're cooking a vegetable, the salt is also going into the vegetable and that will season the inside of it. And that's the best way to do it because you do want salt to penetrate vegetables and make sure that it's seasoned all the way through. Once you then put it into ice water, it doesn't make sense, to just put it in bland water.

Dr Anna Ploszajski [10:37]
Ah, so, so what are you using that ice water for, for, for cooling things down quickly, did you say?

Bhudda Lo [10:42]
Yeah, so, main, mainly vegetables, but we would, you know, whatever, whatever, whatever that we're cooking, yeah, we would, we would, use that salted water for it.

Dr Anna Ploszajski [10:52]
Ah, okay. Interesting. I'm going to start doing that. So, you asked a bit about the kind of chemistry of it. Now as you and listeners will know, as we've already said, a salt dissolves in water. To understand why salt alters the boiling point of water, we first need to understand what water is.

So water is H2O, right hydrogen and oxygen. The shape of the water molecule is a V shape. And really importantly, this shape means that one side of a water molecule is slightly positively charged where the hydrogens are. And the other side is more negatively charged where the oxygen is, when water is just water with nothing else added to it, there are attractive forces between the positive sides and the negative sides of water molecules.

You can maybe imagine them a little bit they're like tiny magnets swimming around. What's happening chemically when you add salt to the party, is that salt's chemical name is sodium chloride, sodium and chlorine. When salt dissolves in water, it becomes charged sodium and chlorine ions which are floating around between the water molecules which as I've said themselves have a slightly positive and negative sides to them.

So, what ends up happening is that the charged sodium and chlorine ions are attracted to the charged sides of the water molecules. These attractions are much stronger than the forces between the water molecules themselves.

Boiling water happens when water molecules are given enough heat energy to break the attractive forces between them and they can go flying off to make a gas. But when there's salt in the water, the water molecules are effectively held back by the charges between them and the salt ions in the liquid. This means that the water molecules need more heat energy in order to break away which is why the boiling point of water rises when salt is added.

So salt is integral to making loads of our everyday materials. I mentioned rubber and glass textiles, paper, and it's also really important to food into our bodies. It's now time to bring in Amy Lamb to tell us more about where it comes from. You know, this is such a precious material. Where does salt come from, Amy?

Amy Lamb [12:46]
Basically, salt comes from two different sources, either from rocks as in the form of rock salt, or from the sea as, from sea salt. Sea salt is basically the evaporation of water, from sea water. to crystallise the salt and then pretty much it's dug up and washed and then sold on as product from our salt operations.

Rock salts on the other hand comes from underground. So, these have been formed over millions and millions of years. It's basically, again, it's the same evaporation process of seawater. But it's done over a long period of time, and you get large deposits of salts underground. And so. You end up, mining the, the salt, from underground. They generally do need a purification step at some stage.

Dr Anna Ploszajski [13:41]
And what sort of scale are we talking here? How big are these processes?

Amy Lamb [13:45]
Uh, depends on the operation. Uh, if, if you look at Rio Tinto's, Damper Salt operation, we use the sea, that sea salt. So, we pump seawater, into evaporation ponds and we have the capacity to produce about 10 million tonnes of salt a year.

Dr Anna Ploszajski [14:03]
That sounds like quite a lot.

Amy Lamb [14:04]
It is quite a lot. And, and to give, put it in perspective, that is equivalent to evaporating 19,500 hectares of water each year.

Bhudda Lo [14:15]
Amy, when you say evaporation ponds, how's it, how's it getting evaporated? What sort of process do you use for that?

Amy Lamb [14:20]
That's another one. It's probably one of the first renewable processes used because it uses the sun's heat and wind to evaporate the water. Now, as you can imagine, it takes a long time for that. And the reason you need so much space is because you can't, you don't want to have very deep ponds. So, you want to have, they're, they're actually quite shallow.

Dr Anna Ploszajski [14:42]
Okay, so you, so you need a lot of space and need a lot of sun and warmth. I imagine you don't do this where I live in London. Where is it done?

Amy Lamb [14:52]
No, you do need a little bit of space and Australia has plenty. So, our Dampier Salt operation is in, is along the coast of Western Australia. Another interesting thing about the Dampier Salt operation is that it's actually been identified as a key biodiversity area for, by Bird Life Australia, because we have migratory birds that come and feast on the invertebrates that are in these ponds, it's actually quite an ecological phenomenon for these sites. So even though we're, we have 27,000 football fields worth of salt ponds, they are part of the ecosystem.

Dr Anna Ploszajski [15:36]
So once you've scraped it off the bottom of your evaporation pools, what happens next? How does it then get processed?

Amy Lamb [15:45]
So, we, we basically assess the quality of the salt and depending on the quality will determine which customer it's best suited for.

Dr Anna Ploszajski [15:54]
I always think of salt when we're talking about a kind of industrial usage. Salt is very pesky when it comes to interacting with other materials, especially steel and iron. You know, salt is a, it's a real accelerant to the rusting process, to corrosion. So, is that something that when you're, when you're using salt on industrial scales with industrial equipment that you have to take into account?

Amy Lamb [16:17]
Absolutely, as, as anyone who's had to drive over iced roads, you do actually witness that corrosiveness as well on your cars. So, yes, in processing, processing, with salt, you do need to adjust the processing methodologies for that corrosive behaviour. So corrosive resistant materials such as stainless steel, obviously regular maintenance and the coating of equipment parts is key to that. Also, corrosiveness also increases the energy consumption in a plant. So, you end up using more energy in your heat exchangers and evaporators if you do have corrosion going on.

Dr Anna Ploszajski [17:00]
Oh, okay.

Amy Lamb [17:01]
So, absolutely, it's preventing corrosion in the first instance is, is quite key to the efficiency of processing salt.

Dr Anna Ploszajski [17:11]
Bhudda, did you have any other, any questions about the kind of industrial processing of salt? Did you have any idea that your salt was coming from these sorts of places?

Bhudda Lo [17:20]
Well, I think that salt, especially with well, you know, we're talking about sea salt and rock salt and, just how, like, how the sea actually really flavour enhances the world, really.

I mean, I'm thinking about seaweeds and kombus and stuff like that. That's like, you know, I'm not sure if it would be in the same sort of topic, but MSG, it is a sodium, but it is a complete different sort of flavour enhancer out there. And that typically that would come from seaweed, kombu. So we're looking at two of our biggest flavour enhancers coming from the sea.

So, it's very interesting just listening to the process of how things were done, how salt's collected.

I'm from Australia. So, it's a massive island surrounded by the sea and it's a lot of land. So, it makes a lot of sense.

And it just makes me think about how at one stage, you know, with 10 million tonnes of salt, I mean, you could possibly be one of the most richest people on the, on the earth at one stage, right?

Amy Lamb [18:24]
Absolutely. I think, to put it into perspective, you know, the salt production in 2022 was 290 million tonnes. And, so, the 10 million tonnes that Rio Tinto produced is only a drop in the bucket, really.

Bhudda Lo [18:41]
Would those salts that they use for the roads still be able to be consumed or would you say that's not edible?

Amy Lamb [18:48]
No, that's a lower quality. Yeah, that's a lower quality salt and hasn't gone through the same purification processes that table salt has gone through.

Dr Anna Ploszajski [19:00]
Yeah, super interesting. Buddha I'm going to now transport you into a terrible world I'm afraid. It's a theoretical world. You're not going anywhere, but I would like for you to imagine that industrial scale salt processing is no longer viable. You still live in your apartment in New York City. What lengths are you going to go to, to source your own?

Bhudda Lo [19:23]
We're going to have to be able to not just be able to just use it for salting water and anymore, it would, you would have to use that.

And, and it'll be just like using truffle or caviar, you know, it's something that's very, there's not a great amount of it. So, but you pay a lot of, you're going to have to pay a lot more for it. So, using that salt was going to taste I wouldn't say better, but when you do get that bit of salt, you're going to be like, wow, this changed my life. So, I'm glad I don't live in a world where salt isn't that scarce.

Dr Anna Ploszajski [19:58]
Amy, when we think about costs, salt is not an especially expensive ingredient to me, I imagine it's, you know, relatively plentiful. Are there any other unseen costs to the people or the places where it's made that do impact, you know, on its kind of sustainability?

Amy Lamb [20:17]
I guess it's pretty similar to other industrial processes as far as the impacts to people in the environment. So, whether it's the, your carbon footprint or the, how much land you need or how much water you use. You know, those are really impacts to the people and the, the cost to society as a whole, we really need to stay mindful of the impact that we do have, when we're developing these projects.

Dr Anna Ploszajski [20:48]
And when it comes to the energy usage, is it possible to make salt 100 per cent carbon neutral or 100 per cent sustainable?

Amy Lamb [20:56]
Well, if you're using renewable energy, I would say, yes. So, using the wind, wind or solar or hydropower, is a great way to, to get towards that net zero goal.

Dr Anna Ploszajski [21:10]
It's so interesting because as soon as we start looking at these everyday objects, you suddenly see, I guess you might call it a carbon footprint, or, you know, you kind of suddenly see the impact that you wouldn't have thought of before. Buddha, have you ever looked at a grain of salt and thought, you know, what, what's been the impact of, of this existing?

Bhudda Lo [21:26]
That's a really big question because it goes, it just blows my mind to think how old salt is and how we've used it and how it's just absolutely changed the world. Before fridges preserving food, you know, that was the main resource to preserve food and I believe like there's been wars over salts, but there's also been wars that have been lost because of salt because if you don't have salt provisions to your boat if you're traveling and whatnot if you're doing long distance traveling like that was the way that you lived. You would have to salt the stuff that you take on board. So, it has longer the shelf life.

Amy Lamb [22:08]
One thing I find fascinating is how long we've, salt has been around. You know, 6,000 years ago was, there's archaeologists have found evidence that salt manufacturing happened that far back. And just one interesting fact is that salts, sea salts, that's that is a renewable resource, because as long as we have oceans, we will have salts. And the other interesting thing, what I heard the forecast for salt demand is going to go up to about 500 million tonnes of salt by 2050.

Dr Anna Ploszajski [22:52]
So, to wrap up, looking to the future, I guess, you know, we've talked about potentially new sustainable processes, new places to find salt, new ways of making sure that it's sustainable and ecological. Amy, are there any particular advancements that you are excited for, that you're looking forward to?

I'm thinking of, for example, of sodium ion batteries, compared to lithium ion batteries, which we also covered on this podcast. The, the argument being, you know, you can, you can have a battery system that operates on sodium that is, as you say, essentially, an infinite resource.

Amy Lamb [23:30]
Yeah, absolutely. You know, and there's, there's lots of advantages to those batteries as well. And one is safety, they, they're not going to start. There's no fire risk, and there's no toxic chemicals involved in those batteries. They're also easily recyclable, and they have a long-life cycle.

Unfortunately, the disadvantages are the costs for those and, and, also they have a lower energy density. So, the batteries need to be larger as it were. And there is some difficulty to building it at scale at the moment. So, it's still, there's still a lot of work happening, and I think it's going to improve.

Dr Anna Ploszajski [24:08]
Yeah, okay, so we won't have we won't have to either have salty dinner or a new battery for our laptop, we might still be able to have both for now.

Amy Lamb [24:18]
Yes.

Dr Anna Ploszajski [24:19]
Buddha, how about for you what cooking adventures await you next?

Bhudda Lo [24:24]
So many. I mean, I just completed Top Chef World All Stars and so winning that has opened up a lot of doors for me, but I think that also spreading the word and making sure that everyone knows about what they eat, what they put into their body, and making sure that, that knowledge, that history, all those sort of things tie into people's backgrounds where, you know, just being able salt something and really understand why we do it.

Like the Koreans do with kimchi, they salt preserve the cabbages and they use that and they have it in their fridges for forever. It's something that everyone could learn how to do and realise how easy it is to actually do.

And I think people, by people learning that sort of thing, people will be a lot more aware of where their food comes from, be a lot more thoughtful on how they consume it and what they do with it, and look for a better future with, with, food. So, I'm, I'm hoping to not only just cook, but also spread the word about the knowledge that I've learned throughout my time.

Dr Anna Ploszajski [25:25]
Well, thank you both so much for sharing your expertise and passion, Buddha Lo and Amy Lamb.

Bhudda Lo [25:29]
Thank you for having us.

Amy Lamb [25:30]
Thank you very much.

Dr Anna Ploszajski [25:31]
Well, I'm off to relive my sea swimming days by eating a kilo of seaweed and an entire Battenberg cake by myself.

You've been listening to Things You Can't Live Without, a podcast brought to you by Rio Tinto. You can listen to more episodes of Things You Can't Live Without wherever you get your podcasts. And don't forget to follow, rate and review us to make sure that you don't miss an episode.

–Ends–