



POOL WATER TREATMENT
ADVISORY GROUP

pH, Alkalinity and Coagulation---flocculation, An operational viewpoint

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In relation to PWTAG guidance

pH and why it is important now more than ever-not a criticism just fact

- Too many operators concentrate on Free Chlorine level rather than pH.
- Chlorine is king is still too prevalent in our industry as shown by most pool log sheets—which is the first test operatives carry out??
- Since 2020, the proven fact was to drop the pH to around pH 7.0- many operators refused to do this as it would affect Langelier etc. due to a complete lack of understanding of the relationship between the two.
- Also, lowering the pH would cause the Alkalinity to lower as well, needing to lift the Total Alkalinity –hence the need to add sodium bicarbonate

pH and Alkalinity

- We therefore need to now understand the continuing relationship between Alkalinity and Coagulation.
- The TA test is normally only carried out to provide a figure for the Langelier test once per week!-fact
- We now need to explore why the TA is so important with regard to Coagulation
- On SPTO/PPO courses to try and explain this relationship is almost impossible
- So lets now move on to the complete coagulation /flocculation cycle

Why?—PWTAG recommendations

- We know that medium rate sand/glass filtration will filter down to 10-20 microns without a coagulant.
- By adding such a process chemical, we can filter down to 1-5 microns
- Crypto for example is around 5microns in size, so cannot be trapped in a media filter without this process
- Work done at Swansea University-Dr Brian Croll/Professor Rachel Chalmers-report a 99.7 log of removal
- Also other bacteria etc can pass through the bed
- Therefore PWTAG recommends the use of coagulation/floc



Coagulation v flocculation—an outline!

- Coagulation and Flocculation ARE NOT the same thing! Despite being talked about in the same breath.
- **Coagulation** is a chemical process where positive and negative reactions happen within the water circulation system and must be recognised as to how they happen.
- A Medical equivalent would be called blood clotting!
- Clotting is the definition of coagulating matter within the blood of Platelets(cells) and proteins within Plasma.



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Coagulation in water

- The definition of coagulation is the electrostatic charges of particles in water
- This will react with particles and colloids in water
- We therefore have to have a media bed to allow these charges to manifest and complete the reaction.
- This of course is our sand/glass bed within the filtration system
- This must be a 2 stage process—Coagulation first and Flocculation second
- This is due to the first process being successful!!-if coagulation does not happen, then Flocculation cannot happen!!

How Coagulation fits into the pool process

- In order to allow Coagulation to take place, the substance is normally based on Iron or Aluminium ie Alum or PAC
- These substances have been used for ages and have proved successful-there are other methods available.
- In order for the first stage of coagulation to take place, the chemical **MUST** be introduced into the system **BEFORE** the filtration unit and needs to have the time to cause the particle collision to take place.
- Hence why PAC is carefully dosed in downstream to the filter.

Flocculation

- If the coagulation has been successful, then flocculation is simply the settling out of the coagulated matter on the filter bed.
- **If coagulation has not been successful then flocculation or sedimentation cannot take place.**
- If there is no filter in place then by adding the coagulant directly to the pool-let it floc in the pool-settle to the bottom and sweep!!!(we used to do it like that!!)-sadly however, this is being picked up more and more today by UK pools from American websites!!!-often said on SPTO courses!!!

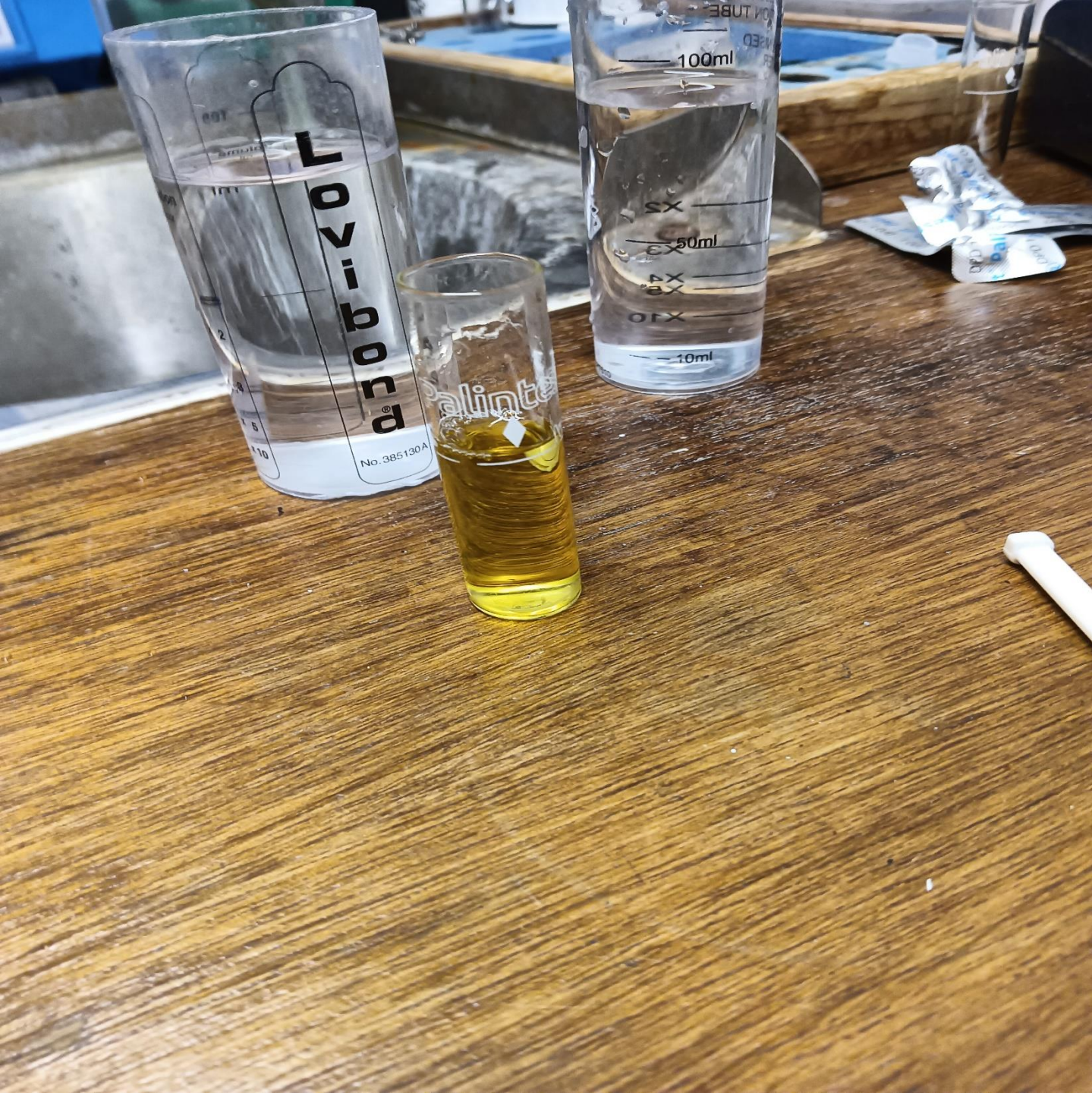
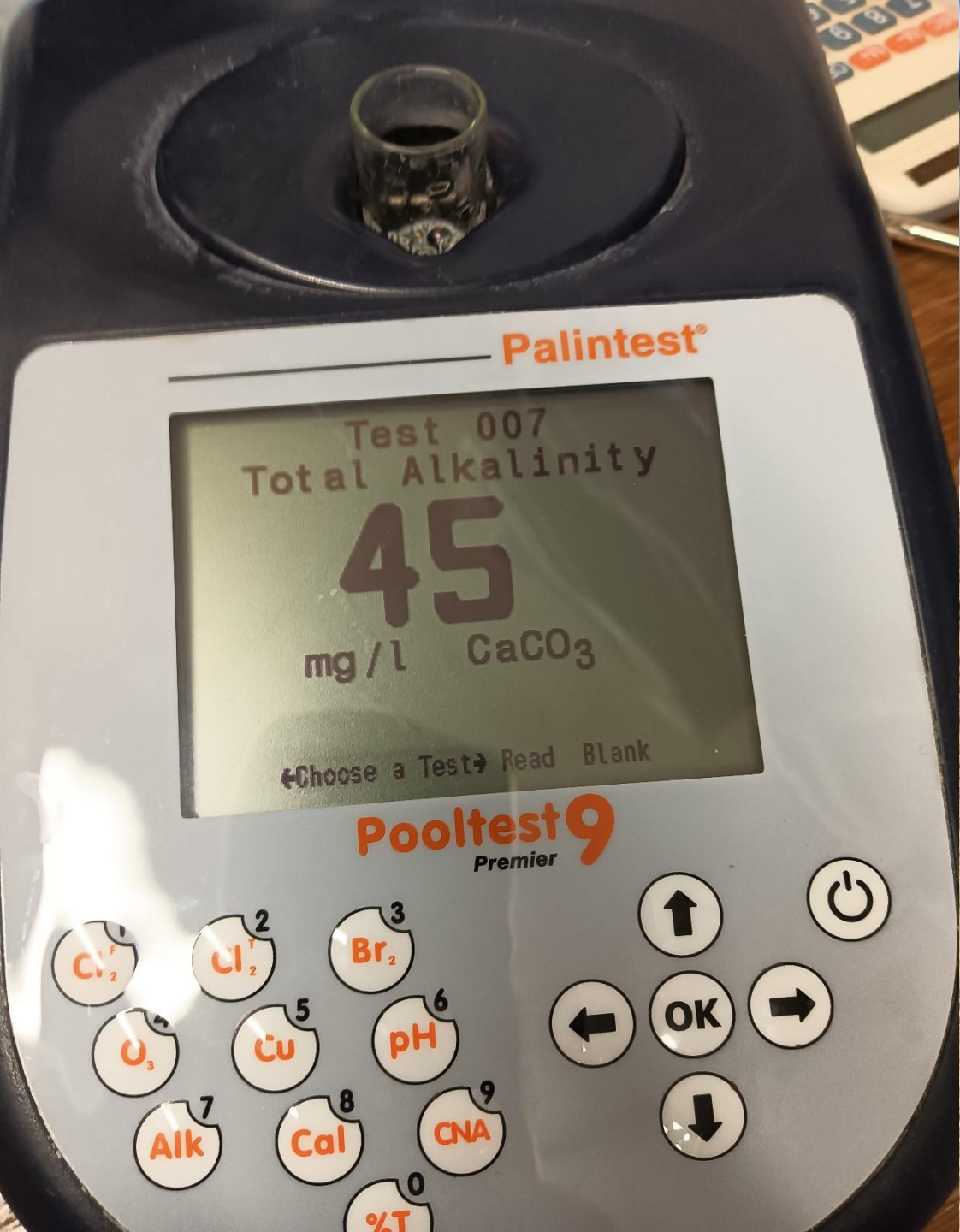
The chemical effect -Alkalinity

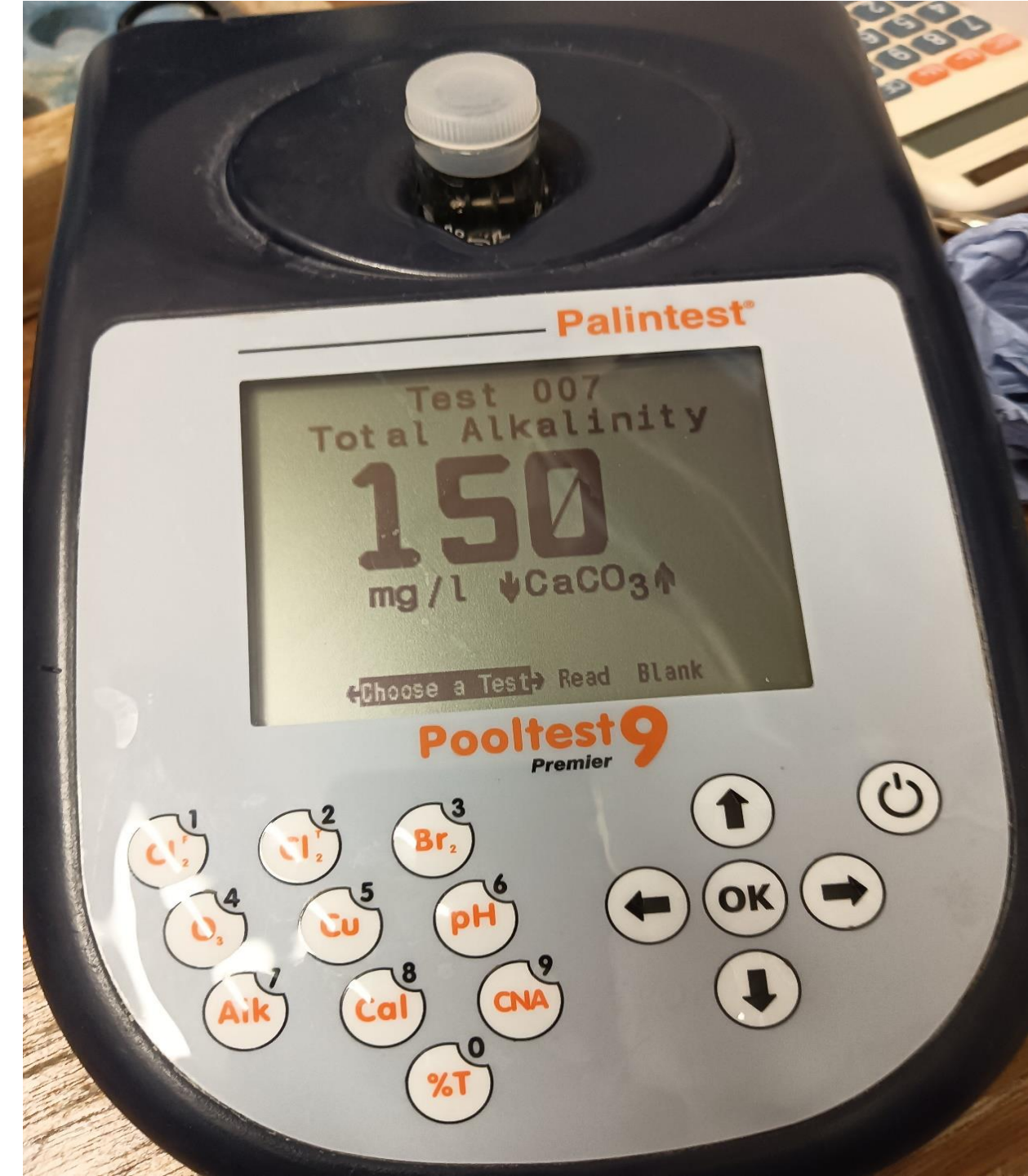
- The coagulants used are acidic in structure(PAC approx. 3.5)
- We all know that alkalis and acids react!!
- It therefore follows that we need an alkaline water to allow the reaction of coagulation to take place.
- Hence the need for the pool Alkalinity level to be sufficient to allow this to happen.
- PWTAG-recommend that a level of 80mg/l -200mg/l will be needed to allow this reaction to happen.

Alkalinity

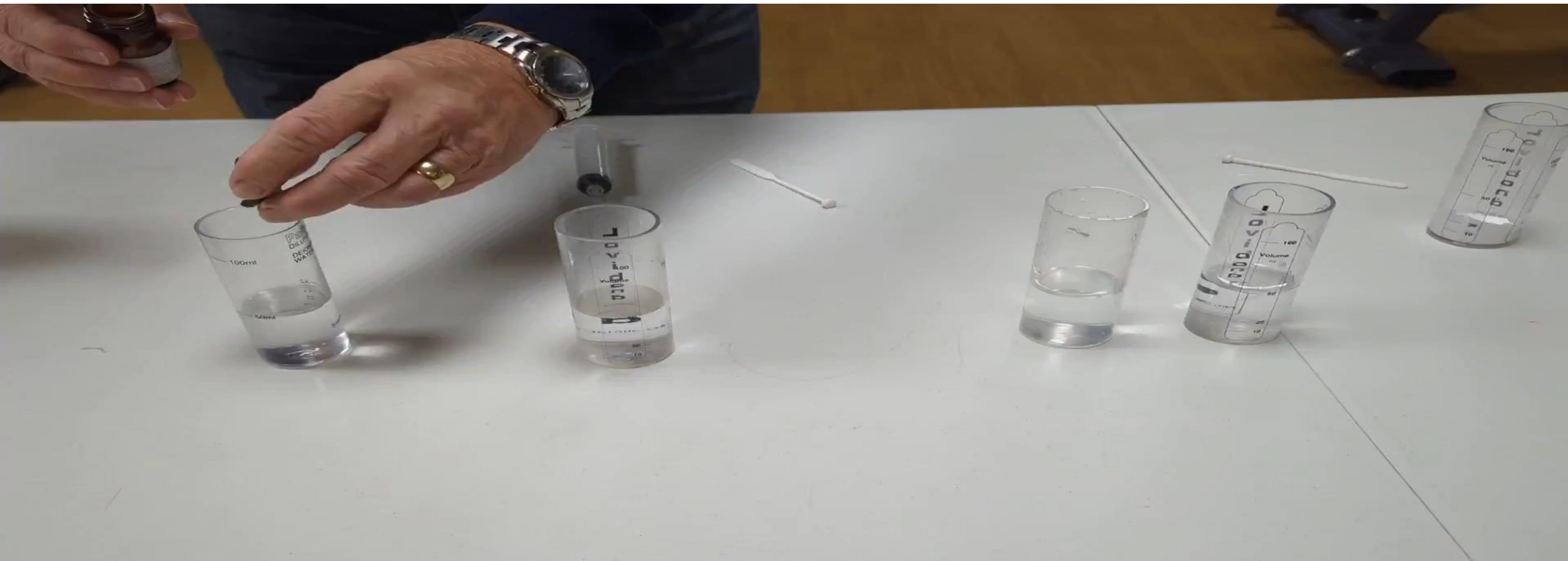
- If the Alkalinity is too low—we know the pH will fluctuate
- So we know that also, the Coagulation cannot take place as the Alkalinity is called upon to assist the pH to maintain its value
- The PAC therefore will be being dosed into the system but is not in actual fact working—costing money with no effect.
- The small desktop experiment proves the point
- Carried out by Assistant Operations Manager for Barnsley Premier Leisure as part of their training programme.
- This experiment has been picked up by both PALM and IOS as part of their course information—it has been well received within the industry

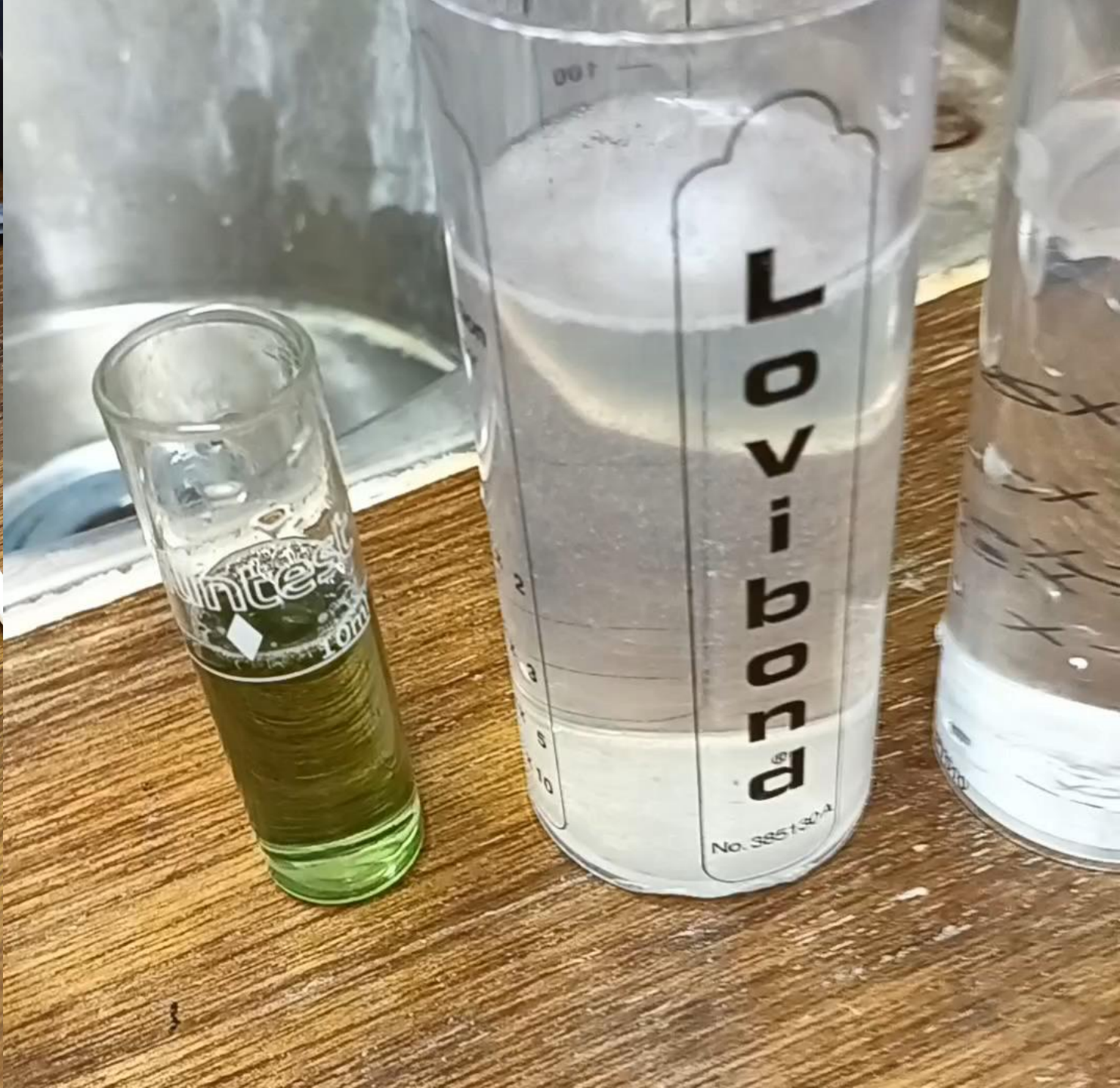
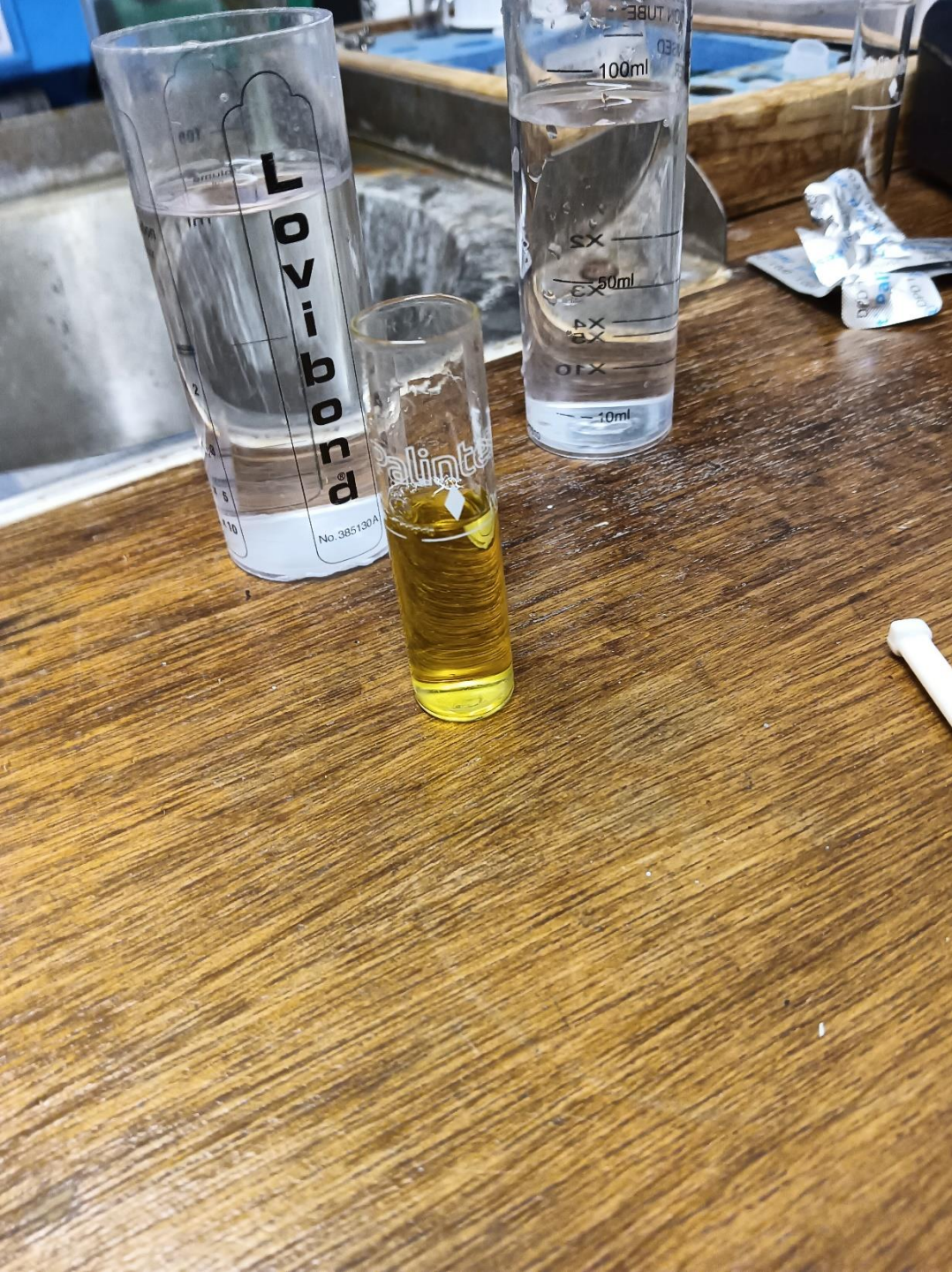






Desk top experiment!





Conclusions

- As we moved onto Alkaline disinfectants, we needed to control the Alkalinity perhaps more than we do as adding Acid to control pH has the effect of destroying this level.
- Monitoring the Alkalinity level is paramount-and not just to complete the Langelier index(another story!!-lets get rid of it ,it was NEVER intended for pools!)
- Perhaps it is the time to install tank and pumps for delivery of Bicarbonate to maintain the levels rather than adhoc dosing manually when required!
- All in All, a stricter monitoring of water quality with regard to these findings is needed.