

# Gungan Spit as Aquatic Adhesive

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Recent events on Mon Cala have revealed that Aquatic creatures, specifically the Gungans, have attributes which can prove useful to the Galactic Republic. An account from Senator Padme Amidala revealed that Gungans have spit which was able to work as a strong sealant and close an opening in her helmet. She stated that the spit was able to travel at a high velocity through the water and had effect almost instantly. It was also described as drying instantly. The following article works to establish if Gungan spit can work as effective adhesive for future republic engagements

## I. INTRODUCTION

For many years, the Galactic Republic has struggled in Underwater conflicts and expeditions. Simply, most of the high-ranking Republican diplomats or Officers are not of species that are adapted to water environments. There are very little civilized and fully integrated species within the Republic who can are able to breathe underwater without additional support. With both details especially applying to the creatures of the most recent conflict on Mon Cala: the Mon Cala and the Quarren.

On Naboo, the war like and primitive Gungans also can breathe effectively underwater. However, most of their capabilities are unknown, as they rarely leave Naboo or actively engage with the Galactic Republic, preferring to stay in their feudal and antiquated political structure.

For a long duration of time, the Republic barely sent underwater troops, and primarily resolved issues through either diplomatic means, or through using Jedi. Although in recent times, as the conflict on Mon Cala has shown, the Republic is heavily underprepared for large-scale aquatic conflicts. Embarrassingly on Mon Cala, the Republic had to request the support of the Gungans, and even then, the conflict was still close.

A strong issue for the Republic is that mass production of underwater tools and breathing materials is very unreliable, and oftentimes, the gear has leaks. Which allows water to flow into the helmets of those wearing them. Potentially drowning and killing them if they are not close to the surface. The Republic has developed adhesive and glues to solve these issues, such as Aqua-Stick, a compound composed of material found from Kete Hives on Endor. However, these compounds of the Kete are still only effectively optimized for land application, as the substance instantly solidifies when in high pressure ocean environments. It also cannot move through the water well and is hard to adjust.

However, there a possible solution, as during the conflict which took place on Mon Cala, Senator Amidala noted that the spit of Gungan Jar-Jar Binks was able to seal a leak she had in her helmet. According to her description of the spit, it was able to travel at a high velocity and stuck and sealed on her helmet almost instantly. Gungan anatomy not only plays a factor in how the spit is created and what it is made of, but also what allows for the substance to be ejected at a high velocity with significant accuracy. Now, the Republic certainly does not want to have an unintelligent Gungan following them on each underwater expedition to provide this adhesive. It is impractical and would lead to a lot of failed missions. However, before the ejection of the spit can

even work, it is important that we test the Gungan spit effectiveness. For the following study, the guiding question is: "Is Gungan Spit a strong aquatic adhesive alternative to Aqua-Stick?" We have hired a Gungan from Naboo and asked them to spit various times and on various materials. We then will take measurements on the spread ability of the spit, how fast it seals gaps, and how airtight the seals it creates are. It will also be tested on glass helmets, plastoid-alloy composites, and standard Republic Fiber weave. These results will also be compared to the effectiveness of Aqua-Stick. The following findings will then be presented with the Galactic Republic Senate, with future discussions and studies being at their discretion.

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## II. THEORY

Aquatic Adhesive forms different theoretical issues and complications than normal adhesive. Foremost, in atmospheric areas, adhesives are easily generated as the heat needed to make them shoot far as projectiles or create an airtight seal are easily available. Further the atmosphere on all planets allows for enough oxygen to hit the adhesive once it makes contact that it takes less than half a second for it to solidify after contact. These core features: heating and atmosphere are not available readily on the ocean, not to mention that the pressure of being underwater prevents these things from moving quickly.

This creates especially difficult challenges, and specific formulas to measure the underwater effectiveness of these adhesive materials are required. The first equation is used to compensate for the refraction of light underwater (variable of 3.2 miliunits per lothalunit ( $d$ ) away from the object), which can skew exact measurements of objects. The next equation is to note how fast the adhesive seals the hole is used to compensate for the low-pressure environment we have in the lab to ensure the results are applicable to an average depth of 3000 feet underwater. The final equation, known as Duma's Law of Air Evacuation, is used to ensure and measure the seal of the Adhesive. This equation considers the level of air flowing in and out of the seal per second ( $f$ ), the width of the original gap, and the width of the sealant. While the equation seems rudimentary the usage of a Atmospheric Hydrocolonizer are needed to measure the air flow. The usage of these equations are not to create exact and definitive measure of Gungan Spit but rather to create base view points and comparisons to see if it is better than current Republican adhesives.

$$3.2d \times w / 3000 \quad (1)$$

$$t / 3000 \quad (2)$$

$$(f / (w_f - w_i)) / 3000 \quad (3)$$

## III. EXPERIMENTAL METHODS

To maintain the consistency of the experiment the contraption found in *Figure 1* was created so the Gungan participant would be spitting from the exact same position. Further the gap of the hole on each of the materials was set at a specific size of 3.5 millimeters. As it is an average size for gaps present in the leaks that the Republican materials has<sup>1</sup>. To ensure that the difference in the materials will not cause a discrepancy in the holes, we utilized a bondar steel saw to ensure precision.

For the application of the Aqua-Stick it is applied using the recommended guidelines, which require that you are directly next to the gap and can apply it manually with your hands. We have utilized an aquatic protocol droid to apply the Aqua-

Stick to the holes to maintain consistency. There were three trials of application for each material.

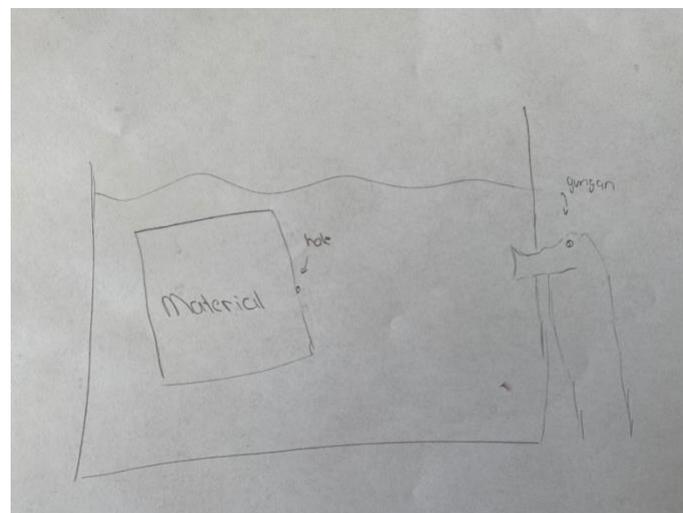


Figure 1 : The Set-Up used to allow the Gungan to Spit form a consistently

It is important to note that there is potential variability in the speed at which the Gungan spits their Saliva. The size of the saliva is also potentially inconsistent, as is the accuracy of the Gungan. So statistical significance measures (using the Taris Test) are utilized and noted for in the Results Section.

The materials used are glass helmets, plastoid-alloy composites, and standard Republic Fiber weave

## IV. RESULTS

The results and tables displayed, are averages of the Raw Data, to access the Raw Data please contact Coruscant College.

Overall, for the Gungan Spit, the Sealing speed was very fast with the speeds for each material being less than a second. Further, the sealing effectiveness of all the materials for Gungan Spit is also very high, with the lowest value being 95%. Another especially important factor to note is that according to the Taris Test, the Gungan Spit results have a significance of .000002. This value means that the results of the Gungan spit are significant and hence these results are not due to chance.

As for the Aqua-Stick the sealing speed was multiple seconds, with some being in the double digits. The Sealing effectiveness of the Aqua-Stick was very high for the Glass Helmet and for the Fiber-Weave, but surprisingly was very low when used on the Plastoid-Alloy. The significance of these results were high as well however, at .0003 according to the Taris test, these results were not due to chance and are reliable

	Sealing Speed (t)	Sealing Effectiveness
Glass Helmet	.02	100%
Plastoid-Alloy	.08	99.839%
Fiber-Weave	.6	95.980%

Table 1: A Table reflecting the Average results of Sealing Speed and effectiveness of the Gungan Spit

	Sealing Speed (t)	Sealing Effectiveness
Glass Helmet	10s	100%
Plastoid-Alloy	12s	70
Fiber-Weave	8s	99.9%

Table 2: A Table reflecting the Average results of Sealing Speed and effectiveness of the Aqua-Stick.

Sources of Error	Size of Error
Gungan Spit Uncertainty	.000002
Systematic Uncertainty	.00003

Table 2 : This table shows the different sources of uncertainty in a measurement.

## V. ANALYSIS

The following results reveal that in nearly all quantitative statistics, Gungan spit is by far the most effective Aquatic Adhesive. It seals incredibly fast and is far more effective than any other Republic Adhesives. It's only weakness is that its sealing effectiveness is not as effective on Fiber Weave in comparison to the Aqua-Stick, but this is not as important.

Not to mention, Gungan spit can be shot at a range, and works very effectively underwater in comparison to the Aqua-Stick. So overall, Gungan spit is by far a more superior choice and easily the best option for the Republic in future underwater endeavors

## VI. CONCLUSIONS

The following results corroborate the experiences of Senator Padme Amidala. Gungan spit is highly effective and works extremely well.

The Galactic Republic should hence reach out to the Gungans and further investigate how to incorporate them into the Republic, so that we can use their Aquatic capabilities to our advantage. This will truly help the Republic be far more comfortable in underwater

expeditions, especially if a Gungan is to go with them. (as long as they are removed from any important action or discussion)

## VII. SUGGESTIONS FOR FURTHER RESEARCH

We suggest that the Republic looks into and funds research for the portability and possibility of storing these devices. Further an investigation of Gungan anatomy is critical to understand how they produce the spit and how to best replicate it.

Permission from the feudal Gungan government will be required but this approval can fuel scientific discovery which will be able to defeat the Separatists in a conflict