presents a test comparing SED results with and without IRAS data, showing they are not crucial to our study.

– Three additional galaxies are not properly fitted[7]. These objects present the characteristics of an AGN and are indeed classified as such (Liu & Zhang 2002). They were not accounted for by the Assef et al. (2018) criterion. It is however consistent with the fact that this criterion has a 90% confidence level.

We have excluded all these problematic fluxes. Criterion (3) is more qualitative than (1) and (2), but it allows us to identify potential systematics that were missed.

In total, we are left with 764 DustPedia galaxies.

The monochromatic fluxes (in Jy) were converted to monochromatic luminosities (in $L_\odot\,\mathrm{Hz}^{-1}$), using the distances from the HyperLeda database (Makarov et al. 2014).

2.1.2. The dwarf galaxy sample

Metallicity is a crucial parameter to study dust evolution (cf. Sect. 5 and Rémy-Ruyer et al. 2014, 2015). In particular, the low-metallicity regime, represented by dwarf galaxies, provides unique constraints (e.g., Galliano et al. 2018), yet the DustPedia sample selected sources larger than 1′. In order to improve the sampling of the low-metallicity regime, we have thus included additional galaxies from the dwarf galaxy survey (DGS; Madden et al. 2013).

Among the 48 sources of the DGS, 35 are not in the DustPedia sample. We have added these sources to our sample. These galaxies have been observed with *Spitzer*, WISE and *Herschel*. We use the aperture photometry presented by Rémy-Ruyer et al. (2013, 2015). We do not expect systematic differences between the DustPedia and DGS aperture fluxes. Appendix B.1 compares the photometry of the DGS sources that are in DustPedia. Both are indeed in very good agreement. Similarly to the DustPedia sample, we apply the three exclusion criteria of Sect. 2.1.1.

1. We exclude the fluxes that have been flagged.
2. No significant AGN contribution is present in this sample.
3. Rémy-Ruyer et al. (2015) advise to not trust the PACS photometry for HS 0822+3542. Since this source is neither detected with SPIRE, we simply exclude it.

In total, we are left with 34 DGS galaxies, in addition to those already included in DustPedia.

2.1.3. Photometric uncertainties

Our combined sample contains 798 galaxies. For each of them, we consider the following two sources of photometric uncertainty.

The noise: it includes statistical fluctuations of the detectors and residual background subtraction. It has been thoroughly estimated by C18 and Rémy-Ruyer et al. (2015). We assume that the noise of each waveband of each galaxy follows an independent normal distribution[8].

Calibration uncertainties: they are systematics, that is they are fully correlated between different galaxies, and partially correlated between wavebands. We assume they follow a joint, multivariate normal distribution, whose covariance matrix is given in Appendix A.

Table 1 gives the number of galaxies observed though each waveband, and the number of detections (flux greater than 3σ, where σ refers solely to the noise uncertainty). The number of available filters per galaxy ranges between 1 and 19, and its median is 11. There is a median number of two upper limits per galaxy.

2.2. The ancillary data

We present here the ancillary data gathered in order to characterize the ISM conditions in each galaxy.

2.2.1. The stellar mass

For the DustPedia sample, we adopt the stellar masses of Nersesian et al. (2019). Theses masses were derived from UV-to-mm SED fitting, using the code `CIGALE` (Boquien et al. 2019), with two stellar populations. For the DGS, the stellar masses are given by Madden et al. (2014), using the Eskew et al. (2012) relation, based on the IRAC1 and IRAC2 fluxes. Eskew et al. (2012) emphasize that the largest source of systematic uncertainties in the stellar mass is the initial mass function (IMF). Both Nersesian et al. (2019) and Eskew et al. (2012) adopt a Salpeter (1955) IMF, therefore limiting potential biases between the two samples. Other potential biases, such as the form of the assumed star formation history, should not be an issue with our sample. For instance, both Mitchell et al. (2013) and Laigle et al. (2019) tested the reliability of stellar mass estimates using numerical simulations of galaxies, and showed that they gave consistent results at low redshift. We use $M_\star$ to denote the stellar mass.

Nanni et al. (2020, hereafter N20) have reestimated the stellar masses of the DGS, with `CIGALE`. They report systematically lower values, compared to Madden et al. (2014), sometimes by an order of magnitude. We discuss the possible reasons of this discrepancy in Appendix B.2, concluding that our estimates are likely more reliable.

2.2.2. The metallicity

For DustPedia galaxies, we use the metallicities derived by De Vis et al. (2019), using the S calibration of Pilyugin & Grebel (2016, hereafter PG16_S). For the DGS, we use the metallicities derived by De Vis et al. (2017a), using the same PG16_S calibration. De Vis et al. (2017a) show that this particular calibration is the most reliable at low-metallicity.

We adopt the solar elemental abundances of Asplund et al. (2009): the hydrogen mass fraction is $X_\odot = 0.7381$, the helium mass fraction, $Y_\odot = 0.2485$, the heavy element mass fraction, $Z_\odot = 0.0134$, and the oxygen-to-hydrogen number ratio, $12+\log(\mathrm{O/H})_\odot = 8.69\pm0.05$. Throughout this study, we assume a fixed elemental abundance pattern. It implies that the total metallicity, Z, scales with the oxygen-to-hydrogen number ratio as:

$$Z \simeq 2.04\times10^{-9}\times10^{12+\log(\mathrm{O/H})}\,Z_\odot. \quad (1)$$

For that reason, in the rest of the paper, we refer to both Z and $12+\log(\mathrm{O/H})$, as metallicity.

[7] Those are: NGC 1052, NGC 2110 and NGC 4486.

[8] We note here that the background subtraction introduces an uncertainty which is independent between galaxies. Indeed, we estimate the background in each waveband for each galaxy separately. The resulting biases are thus randomly distributed across the sample. It would not have been the case, if we had considered individual pixels inside a galaxy.